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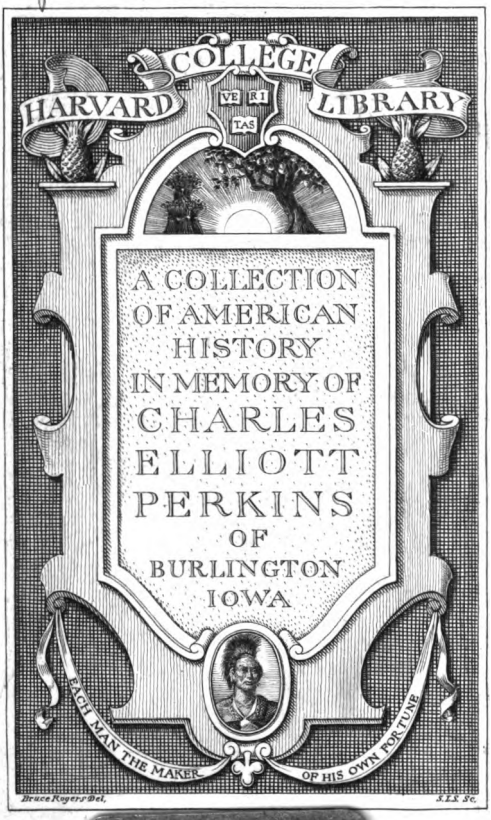

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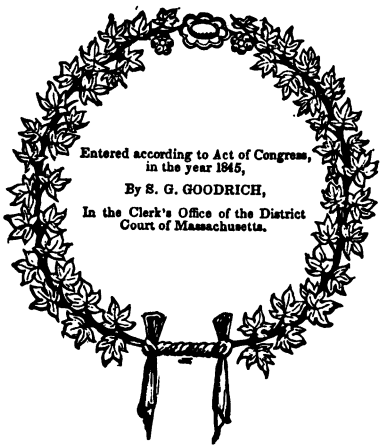

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THE

WORLD AND ITS INHABITANTS.

If a being of some other sphere, gifted with the powers of traversing the regions of space, should chance to meet with our earth in one of his trackless voyages, we may suppose that he would pause to contemplate the new world he had thus discovered. Under such circumstances, we may imagine that his attention would be arrested by the diurnal revolution of the strange planet, and the wondrous spectacles which this movement would unfold. The transition from a world enveloped in darkness and slumber and seeming death, to a world of life and beauty and action and rejoicing, could not fail to impress the beholder with curious and pleasing wonder. We can easily imagine, that, enchanted with the scenes disclosed by the rising of the sun upon the earth, he would accompany that glorious luminary, at least for a single day, and thus survey the various regions upon which he pours his beneficent light, and heat, and power.

Having contemplated these sublime phenomena, we can readily believe that the stranger would lift his hands and heart in adoration of the skill, and wisdom, and goodness of that Being, who had thus not only created a sun, but a world, and peopled it with myriads of

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living, sentient beings, adapted to live, and breathe, and rejoice in its beams. Under such circumstances, the soul of the voyager would not be chilled with atheistic doubts, nor could his mind stumble upon the apprehension that all this beautiful machinery, so admirably adapted to useful and benign ends, could be the work of blind accident or unthinking chance. His mind enlightened, his bosom elevated by the glorious view, he would as readily trace in its results the evidence of an omnipotent and benignant Designer, as if he had seen him at his work. May we not suppose that, under the impulse of the moment, he would exclaim, "Yonder glorious orb, and this revolving planet, are indeed wisely adapted to each other. Upon this earth, which, but for the sun, would be shrouded in everlasting darkness, are myriads of living beings, which could not live without its light and heat; yet, every day, that luminary comes to bestow these blessings. If we see benignant care in a parent who daily provides food for his children, can we behold an inferior degree of beneficent design in the creation of myriad races to enjoy light and heat, and the provision of an exhaustless and daily returning fountain of these benefits?"

Such, we may suppose, would be the impression made upon the spirit-voyager, who, in its pathless journey, should chance to discover our earth. And shall we, tenants of this planet and bound to the common destiny of its inhabitants, take a humbler or less philosophic view of the theatre in which we make our appearance on the stage of immortal existence! Is it not fit that in beginning our contemplation of the "World and its Inhabitants," we should start with a due sense of the sublimity of that system of which

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we are a part, and the mighty machinery of which we have minds to comprehend? And let us not fail to reflect with due sensibility upon the fact, that such powers cannot have been given but to be rightly used; but to appreciate and feel and enjoy the works of God; to acknowledge his goodness; and to fulfil his purposes by giving the utmost growth and elevation to the nobler endowments of our nature!

"Our globe," says Turner, "consists of its earthy structure, — of the etherial fluids which move upon it and above it, — of the watery masses and effusions, — of the vegetable kingdom, — and of the animated races. It is subject to the potent and varied agencies of the sun and moon. It rolls, with undisputed and unsupported freedom, through a boundless space; and it is connected by immediate relations with the planets of our system; more remotely, with the splendid stars, whose nature and numbers we have not yet ascertained; and occasionally, at intervals, with the rapidly-moving comets, some of which are recurrent. These rush suddenly and unexpectedly, for the most part, into our visible heavens, by laws and for purposes yet unknown; rather advertising us of their existence, and amazing us by their appearance, than exercising any perceptible effect, or imparting any knowledge of their composition, of the causes of their journey, or of the places from which they come and to which they so mysteriously depart. In this grand system of existence, man is the most intelligent being that is visible to our material sense." Regarding our earth in this light, we shall proceed to consider it as a member of the solar system, and of the great brotherhood of stars with which it is so wonderfully allied.

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ASTRONOMICAL VIEW OF THE EARTH.*

THE earth is a globe or ball, depressed at the poles, and being about thirty-four miles more in diameter at the equator than at its axis. By its diurnal revolution, which is completed in about twenty-four hours, we have day and night, and by its annual revolution, performed in about 365 days, we have the seasons of spring, summer, autumn, and winter.

The surface of the earth is diversified by land and water; the latter predominates, occupying about 148,000,000 out of 200,000,000 square miles, contained in the entire area of the globe. The circumference of the earth is nearly 25,000 miles, and its diameter about 8,000.

The earth is one of eleven planets, which revolve around the sun, as their centre. Seven of them — Mercury, Mars, Venus, Ceres, Pallas, Juno, and Vesta — are smaller than the earth, and three — Jupiter, Saturn, and Herschel — are larger than the earth.

These orbs revolve around the sun at different dis-

* Our design is here to present only a popular outline of astronomy; for a more detailed view of the subject, see "Glance at the Sciences."

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tances, and complete their diurnal and annual revolutions at different periods. They all move in the same plane, and in the same direction; that is, from west to east. The planets are of different densities, the substance of Mercury being as heavy as lead, and that of Jupiter no greater than that of cork. Their light, derived from the sun, varies, that of Mercury being seven times as great as that of the earth, and that of Uranus or Herschel 360 times less. The planet nearest the sun is Mercury, yet its distance from that orb is 37,000,000 miles; that of the earth 95,000,000, and that of Uranus 180,000,000. Their speed in passing through their orbits is various; the earth flies along its track, bearing its burden of oceans and continents, at the rate of 1,000 miles a minute, and in its yearly journey travels the distance of 567,000,000 miles. The bulk of the earth is so great as to overwhelm the imagination, yet Jupiter is 1,400 times larger, and the sun 1,300,000 times larger.

Several of the planets have attendant satellites, of which our moon is an example. This body is about 240,000 miles from the earth, and one fiftieth of its size. It attends the earth in its yearly circuit, and revolves around it in about twenty-nine days and a half. It turns on its axis in the same time the earth does, and with such precision as always to present the same side to the earth. The moon is found, by the astronomers, to present a very rugged surface of mountains and valleys, but it has no water, and little or no atmosphere. As far as known, none of the other planets have satellites except Jupiter, which has four, Uranus, six, and Saturn, seven, with a resplendent double ring.

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Besides the eleven planets, there are comets, which appear at intervals in the heavens, and, after passing round the sun, shoot off to unknown distances in the regions of space. These wandering bodies are of a gaseous consistence, and are usually attended by luminous trains, millions of miles in length. From the earliest ages they have excited the wonder of mankind, and in the darker ages of the world have excited their superstitious fears.

Such is a brief view of the planetary system; but it is now generally admitted that the stars, of which such multitudes appear in the sky, are each a sun, around which troops of attendant planets are wheeling, as do ours around their central luminary. There are about 2,000 of these stars visible to the naked eye, but the telescope discloses a countless swarm of these occupants of the sea of space.

By the investigations of the two Herschels, the heavens have been explored in all directions, and the result is a conviction, that, as the planets are parts of solar systems, so these systems are themselves parts of what may be called *astral* systems, — that is systems composed of suns or stars, bearing a relation to each other. The astral system to which we belong is called the *milky way*, and has always attracted the admiring gaze of mankind. The form of this shoal of stars is defined, and our place in it is ascertained. Though our sun seems at rest, it is believed to be moving from west to east, accompanied by the other suns of the system, around the stupendous ring of which the milky way is composed.

Amazing as is this complication of suns and planets

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and satellites, we have still entered only the threshold of the heavens. The elder Herschel, directing his wonderful tube towards the *sides* of our system, where stars are planted most rarely, and raising the powers of the instrument to the required pitch, was enabled, with awe-struck mind, to see suspended in the vast empyrean other astral systems, or, as he called them, firmaments, resembling our own. Appearing like light clouds to a certain power of the telescope, they resolved themselves, under a greater power, into separate stars, though these generally seemed no larger than the finest particles of diamond dust. The general forms of these systems are various; but one at least has been detected seeming to bear a striking resemblance to the supposed form of our own. The distances are also various, as proved by the different degrees of telescopic power, necessary to bring them into view. The farthest observed by the astronomer were estimated by him as thirty-five thousand times more remote than Sirius, supposing that to be about twenty thousand millions of miles from our earth.

Nor are even these amazing firmamental systems the whole of the revelations unfolded by the telescope. Within our own astral brotherhood, and generally in its outer fields, a great number of objects, which, from their foggy, cloudlike appearance, are called *nebulæ*, have been discovered. These are of various forms and sizes. In similar regions other objects are discerned, which appear like *nuclei* with nebulous circles around; and still others, which seem like stars with only slight burs encircling them. From these and other facts, it is concluded, with every degree of probability, that these

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are materials in various stages of progress toward formation into stars, — and that we may hence infer the process by which not only our own globe, but all other worlds are formed.

In the first place, we suppose matter to consist of diffused luminous particles, to which we may give the name of *fire dust;* in the progress of ages, these particles, which are kept asunder by the heat, are gradually drawn toward each other by gravitation, at the same time parting with a portion of their heat. Just as the particles of a drop of water arrange themselves in the form of a globe, so the particles of this subtler fluid arrange themselves into a globular form. As the current of particles falls constantly upon the outer edge, they give the mass a rotary motion. In the course of countless centuries, the whole mass of particles is consolidated, and the new sun or planet is formed, and, obedient to the mandate of the laws of the universe, takes up its line of march, and thenceforward performs its mazy evolutions in the heavens with undeviating precision.

Such is the general result of the researches of astronomers. The subject opens to the mind a spectacle of overpowering sublimity. We see that myriads of worlds are formed in space, and that others are at present in process of formation. Of the relative ages of these several orbs we can know nothing, but there is reason to believe, that our own planet is one of the younger members of this legion of worlds.

The amazing distance of the planets from each other, and from the stars that stud the heavens, might make us feel that an impassable gulf separated them

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and us for ever, and excluded the possibility of the remotest sympathy between us and their inhabitants; but due reflection will teach us to feel that all these systems have come into existence by the command of the same Creator, and through the operation of the same laws. If we consider the planets, we shall notice that there is a regular decrease of density and increase of bulk as they are farther from the sun. In respect to density, if we take water as the standard, and count it as one, we shall find that Saturn is $\frac{1}{32}$, or less than half; Jupiter, $1\frac{1}{4}$; Mars, $3\frac{3}{7}$; Earth, $4\frac{1}{2}$; Venus, $5\frac{11}{15}$; Mercury, $9\frac{9}{10}$; or about the weight of lead. Then the distances are curiouly relative. It has been found that if we place the following line of numbers,

0 3 6 12 24 48 96 192,

and add 4 to each, we shall have a series denoting the respective distances of the planets from the sun. It will stand thus:

4	7	10	16	28	52	100	196
Mercury.	Venus.	Earth.	Mars.	Jupiter.	Saturn.	Uranus.	

It will be observed, that the first row of figures goes on, from the second on the left hand, in a succession of duplications, or multiplications by two. Surely there is here a most surprising proof of the unity of the solar system. It was remarked, when this curious relation was first detected, that there was a want of a planet corresponding to twenty-eight; the difficulty was afterwards considered in a great measure overcome by the discovery of four small planets, — Ceres, Pallas, Juno, and Vesta, — revolving at nearly one mean distance from the sun, between Mars and Jupiter. The distances bear an equally interesting mathematical relation to

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the times of the revolution round the sun. It has been found that, in respect to any two planets, the squares of the times of revolution are to each other in the same proportion as the cubes of their mean distances, — a most surprising result, for the discovery of which the world was indebted to the illustrious Kepler.

While we thus observe, with admiring wonder, the unity of the laws which govern the different members of the solar system, we shall find our amazement increased if we extend our view to the starry systems beyond; for we cannot fail to observe that the same principles appear to regulate the movements of those remoter spheres. Nor are these independent of each other: the whole are linked inextricably together in their revolutions, though all are so far apart and so nicely balanced, that each may perform its separate and peculiar functions. Yet the laws which cause the rotation of their mighty masses, and still hold them in their orbits, is exactly the same which produces the familiar phenomenon of a small whirlpool, or dimple in the surface of a stream. Such dimples are not always single. Upon the face of a river where there are various contending currents, it may often be observed that two or more dimples are formed near each other, with more or less regularity. These fantastic eddies, which the musing poet will sometimes watch abstractedly for an hour, little thinking of the law which produces and connects them, are an illustration of the wonders of the double and triple stars, or binary and ternary systems, discovered in the heavens.

"We have spoken of the laws which govern the movements of the heavenly bodies, and it may be

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matter of interest to inquire what they are. All that can be said in answer is, that we see certain natural events proceeding in an invariable order under certain conditions, and thence infer the existence of some fundamental arrangement, which, for the bringing about of these events, has a force and certainty of action, similar to, but more precise and unerring than, those arrangements which human society makes for its own benefit and calls laws.

"It is remarkable of physical laws, that we see them operating on every kind of scale as to magnitude with the same regularity and perseverance. The tear that falls from childhood's cheek is globular, through the efficacy of the same law of mutual attraction of particles which made the sun and planets round. The rapidity of Mercury is greater than that of Saturn, for the same reason that when we whirl a ball round by a string, and make the string wind up round our fingers, the ball always flies quicker and quicker as the string is shortened. Two eddies in a stream, as has been stated, fall into a mutual revolution at the distance of a couple of inches through the same cause which makes a pair of suns link in mutual revolution at the distance of millions of miles.

"There is, we might say, a sublime simplicity in this indifference, in these grand regulations, to the vastness or minuteness of their operations. Their being uniform, too, throughout space, as far as we can scan it, and their being so unfailing in their tendency to operate, provided the proper conditions are presented, afford to our minds matter for the gravest consideration.

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"Nor should it escape our careful notice, that the regulations on which all the laws of matter operate are established on a rigidly accurate mathematical basis. Proportions of number and geometrical figures rest at the bottom of the whole. All these considerations, when the mind is thoroughly prepared for them, tend to raise our ideas with respect to the character of physical laws, even though we do not go a single step further in the investigation. But it is impossible for an intelligent mind to stop there. We advance from law to the cause of law, and ask, What is that? Whence have come all these beautiful regulations? Here science leaves us, but only to conclude, from other grounds, that there is a First Cause, to which all others are secondary and ministrative, a primitive Almighty Will, of which these laws are merely the mandates. That great Being, — who shall say where is his dwelling-place, or what his history! Man pauses breathless at the contemplation of a subject so much above his finite faculties, and only can wonder and adore!"

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GEOLOGICAL HISTORY OF THE EARTH.*

GEOLOGY is the natural history of the earth, as gathered from an examination of its mineral masses. While other sciences are written on paper, this is recorded in the *Stone Book*, of which the eternal rocks are the leaves. We depend not here upon human testimony; but we delve into the bowels of the earth, and, gathering the bones and relics which have there been sepulchred for ages, we question these and record their wondrous revelations.

Astronomy teaches us, that the materials of our solar system were originally in a fluid or gaseous state. As the sun was in process of formation, from time to time it threw off fragments, which were condensed into planets. Our earth was one of these, and it was thus created, doubtless by an operation which extended through millions of ages.

In its original condition, we suppose the earth to have been a molten mass, and to have gradually hardened as it cooled. While its outer surface thus became solid rock, it is supposed that the interior continued to be in a state of fusion, and remains in that condition to the present day. This curious theory is strongly confirmed by the fact, that as we descend

* For a fuller view of this subject, see "Wonders of Geology."

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into the bowels of the earth, though we depart from the sun, the heat still constantly increases.

In the process of cooling, we suppose that mighty rifts took place in the surface of the earth, thus throwing up immense mountains, perhaps a hundred miles in height, and excavating deep corresponding valleys. This conjecture acquires plausibility from the fact, that geological researches seem to prove that there were seas, in the early ages of the world, a hundred miles in depth. At this period, it seems that the condition of the earth was not very unlike that of the moon, which now presents a rugged surface, without water, where steep, angular mountains rise to a dizzy elevation, and cast their gloomy shadows over the grisly ravines which yawn at their feet. It may be that the moon, now destitute of those elements which seem essential to life, may still be in progress toward a period when its hollows will be filled with seas, and the soil be formed in which vegetation may spring up, and provision thus be made for animal life.

The surface of the earth has been explored to such a depth, that it is ascertained to consist of two great classes of rocks: — *First*, those of a crystalline character, of which granite is the type, and which seem to have been formed by fire. These are called *primary*, as having been first formed, and are supposed to be the platform on which all the other rocks and materials of the globe rest. *Second*, those of a stratified character, and which appear to have been formed by gradual deposits in water. The latter originally must have been laid level and horizontally; but uneasy movements from below have broken them up, and placed them in every variety of position. Thus we find, all over the

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world, these two great classes of rocks tumbled together, though the latter are, in the main, laid above and upon the others.

The two great agencies which have produced these phenomena are supposed to be fire and water: the former operating, in the form of earthquakes and volcanoes, to disturb the rocky fabric of the earth, and the latter, by frost, rain, rivers, and seas, to disintegrate, by slow degrees, the original rocks, and deposit new ones in the vales below.

By exploring the mineral masses of the earth, it has been discovered that some of these contain the bones, and other fossil remains of animals and vegetables, now extinct. This curious fact has stimulated inquiry, and led to the most surprising results. It appears that in the igneous or primary rocks, none of these are found; but they become more or less abundant as we approach or recede from the surface of the earth. In the lower stratified or water-formed rocks, many of which are of limestone, few of these organic remains are discovered, and these chiefly consist of zoöphytes and algæ, the lowest forms of vegetable and animal life.

As we ascend, and explore the rocks above them, which are called the *old red sandstone system*, we find the remains of fishes, of various forms, together with the zoöphytes before mentioned, but as yet no land animals had existence, for there was no dry land. If we now explore the rocks of the next period, that of the *carboniferous system*, we shall discover the remains of various land animals, and a great variety of new species of plants. The trees of this period were leafless and flowerless, but they were luxuriant beyond any thing now known upon the earth, and seemed to

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indicate a climate over the whole earth much hotter and moister than that of the present tropics. This rank vegetation is supposed to have furnished the materials for the vast coal beds now found in every quarter of the globe.

The *new red sandstone* lies above the carboniferous rocks, and in this we find new races of animals, particularly various species of lizards, and of which no type had before appeared on the earth. Reptiles, of strange forms and gigantic proportions, some endowed with the fish's paddle, and others with the bird's wing, teemed in the waters, or haunted the fens, of this wondrous period.

In the strata of a still more recent formation, called the *oölitic period*, we begin to find the first traces of the great class of mammalia, or sucking animals, which constitutes the mass of our four-footed beasts. As we rise still higher, and advance to the later or alluvial formations of the earth's surface, we see constantly new races of animals appearing upon the theatre of life, until at last man, and the races associated with him, together with the vegetation of our own time, occupies and possesses the earth.

Thus we read the "earth's history of itself," — a wondrous record, and leading to many momentous inferences. It teaches us that our curious chronology, which assigns to the earth but an existence of 6,000 years, is incorrect, and that our planet has doubtless rolled through its orbit for myriads of ages, gradually advancing in development, until it was prepared to be the habitation of man, when, according to the Mosaic record, man appeared upon the stage of action, and, according to divine appointment, became the lord of creation.

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GEOGRAPHICAL VIEW OF THE EARTH.*

DISTRIBUTION INTO LAND AND WATER.

When we cast our eyes over an artificial globe, we see that the surface of the earth is divided into two principal masses of land, which we call *continents*, and great cavities, filled with water, which we call *seas*. As in the parts covered with water we observe small masses of land whose surfaces rise above it, which we name *islands*, so are there upon the continents small detached spots covered with water, which we call *lakes*. An island differs from a continent only in its dimensions.

Many portions of the land and of the sea extend reciprocally the one into the other. If the sea penetrate into the interior of any continent, it forms then a *mediterranean*, or inland sea, surrounded almost on all sides by land, and having only a narrow opening into the ocean. If the extent of such seas be less, and the opening larger, they are called *gulfs* or *bays*. The still smaller portions of sea, surrounded as it were by land, and which afford a shelter for ships, are called *ports*, *creeks*, or *roads*.

* For a geological view of the earth, see "Wonders of Geology," and for Meteorology, see "A Glance at the Physical Sciences."

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The first term means a secure asylum; the second is applied to places or ports of much smaller size, which, when improved or completed by artificial aid, are styled *harbours*, and the roads afford only a temporary anchorage and security from certain winds.

If, on the other hand, parts of the continents shoot into the seas, and are connected with the main land by only a small portion of their circumference, they are named *peninsulas*, whose figures often correspond with those of gulfs and inland seas.

If the projections of land reach but a little way into the sea, they are called *capes*, *promontories*, or simply *points*. A natural canal, communicating with the sea at both ends, and confined by two opposite shores, is called a *strait*; the reverse is an *isthmus*, that is, a tongue of land running between two seas, and by which two greater masses of land are united. Many other terms of a similar kind are used in geographical description, but it is unnecessary to notice them here.

If we consider the surface of the globe under one general view, we perceive that it consists of one vast ocean, in which a great number of *islands* are placed, whose size varies from that of the most colossal to the most minute. Two of these islands are termed continents; that which is inhabited by the oldest civilized nations is called the *old continent*, and contains three divisions of the world, namely, Asia, Europe, and Africa, while the whole of the new continent is comprised under the name of America, though nature has divided it into two distinct peninsulas, one of which ought, in strict historical justice, to be called Columbia. In the midst of the most extensive mass of waters is placed New

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Holland, which many geographers call a third continent, although it is perhaps more correct to consider it as by far the largest island in existence.

When we find a considerable number of islands grouped together, we give the name of *archipelago* to the whole. The vast archipelago which extends to the east of the ancient continent, and in the centre of which New Holland rises majestically, seems worthy of being considered as a new division of the world, which we shall distinguish by the name of *Oceanica*.

There is upon our globe, properly speaking, only one sea, — one continuous fluid, spread round the land, and which probably extends from one pole to the other, covering nearly three fourths of the surface of the earth. All the gulfs, all the inland seas, form only portions detached, but not entirely separated, from that universal sea, which we call the ocean. It is only for the sake of greater convenience that we distinguish different parts of the ocean under the name of *seas*. These may be classed in the following manner, the propriety of which may be easily seen by glancing at a map of the world.

I. The great *Southeastern Basin*, the waters of which cover nearly half the globe, includes, —

1. The *Pacific Ocean*, 11,000 miles in length from east to west, and 8,000 in breadth, occupying a superficial space rather larger than the whole mass of the dry land. It extends from Behring's Straits on the north to a line drawn from Cape Horn to Van Diemen's Land on the south; and from America on the east to Asia, Malaysia, and Australia on the west. In consequence of the wide expanse of its surface, it is remarkably exempt

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from storms, except near its mountainous shores, and hence its name. It is often, also, called the South Sea.

2. The *Indian Ocean*, lying between Africa on the west and Malaysia and Australia on the east, and between Asia on the north and a line drawn from the Cape of Good Hope to Van Diemen's Land on the south, is about 4,500 miles in length and breadth; it covers a surface of about 17,000,000 square miles.

3. The *Southern* or *Antarctic Ocean* surrounds the south pole, lying to the south of a line drawn quite round the globe from Cape Horn, along the southern extremity of New Zealand, Van Diemen's Land, and Africa, back to the point of starting. It embraces an area of 30,000,000 square miles. It is generally covered with floating ice as far north as 60° S. Lat., and in higher latitudes appears to be almost blocked up by an impenetrable barrier of fixed ice. Recently land has been discovered here, which is supposed to be an Antarctic continent.

II. The *Western Basin* forms a channel between the eastern and western continents, and washes their northern shores. It includes,—

1. The *Atlantic Ocean*, stretching from the Southern Ocean to the Arctic circle; it is about 8,500 miles in length, varying much in breadth, and it covers an area of 25,000,000 square miles.

2. The *Arctic Ocean*, surrounding the north pole; it is in part covered with impenetrable fields of perpetual ice, and it contains large masses of land of unknown extent. It is often called the Icy or Frozen Ocean, or Polar Sea.

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Although it presents to the eye only the image of a watery waste, the ocean sustains an important part in the economy of nature. It is the fountain of those vapors which replenish the rivers and lakes, and dispense fertility to the soil. By its action on the atmosphere, it tempers the extremes of heat and cold. It affords an inexhaustible supply of food and of salt, a substance hardly less important. As the great highway of commerce, it connects the most distant parts of the globe, affording facilities of intercourse to nations the most remote from each other.

LAND SURFACE OF THE GLOBE.

In a general survey of the globe, we are struck with the great preponderance of land on the northern side of the equator. Of the two great continents, only two small projections extend into the southern hemisphere. This unequalled distribution is in some degree compensated by the great island of Australia, and the Antarctic continent recently discovered, which is supposed to extend entirely around the south pole.

Continents. — The Eastern and Western continents present a remarkable similarity in the direction of their great promontories and peninsulas; nearly all having a southerly projection. This is the case with South America, California, Alaska, Greenland, Acadia, and Florida; with Scandinavia, Italy, Greece, Arabia, India, Corea, Kamtschatka, and Africa. The two exceptions to this are the peninsulas of Yucatan and Jutland, which

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stretch towards the north. These, however, are only alluvial plains of a moderate extent.

In respect to the configuration of the two continents, there is, however, a striking difference. The ancient world is in almost every part open to the advances of the ocean, and from Behring's Straits to those of Babelmandel on the one side, and to those of Gibraltar on the other, the bays, gulfs, inland seas, &c., are as it were in a sort of equilibrium, at least with respect to numbers; while the mass of Africa is not penetrated by one single arm of the sea. The new continent, on the contrary, having only one considerable gulf, that of California, on its western shore, presents, on the opposite coast, a chain of gulfs and inland seas; when these are wanting, some immense river is found to supply the link.

MOUNTAINS. — Among the most remarkable features of the land surface of the globe are *mountains*. These in their exterior forms present some varieties which strike even the most inattentive observer. The highest elevations frequently present a surface of naked rock; but the nature of this produces varieties in their outline and aspect; here they shoot up in the form of enormous crystals, with sharp angles heaped up and supported by each other; in another part, vast and elevated masses are crowned with circular summits, which rise into the air with less boldness. Sometimes there appears an immense steep and abrupt surface, which lays open to view, as it were, the entrails of the mountain itself. We describe these appearances under the name of needles, peaks, teeth, horns, domes, breaches.

Next in order to these broken and steep summits, we see mountains the forms of which bear a character of

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tranquillity, an indication of their slow and successive formation; these mountains, which are still considerable, formed by strata or layers variously inclined, generally exhibit an infinite variety of forms, in consequence of the changes to which, from numberless causes, they have been subjected. In one place, a vast amphitheatre is seen rising in majestic and regular gradation, like the Kinnegulla, in West Gothland. In another, there is a large mass cut perpendicularly, and presenting the form of an altar, like the Table Mountain at the Cape of Good Hope. There are mountains in China, which have the appearance of a head of a dragon, a tiger, or a bear. In other places, you see a labyrinth of rocks rising like pillars, as at Adersbach in Bohemia, or in one single mass, in the form of a large ninepin, as Monte Aiguille, in the province of Dauphiné. We see some also near Euviconne in the Valois, which recall the figure of the old French frizzled wigs. But the most common appearances are those formed by layers of stones, in an undulated or furrowed shape.

After these mountains of the second rank, we find hills, more or less lofty, which on all sides present to the eye but little elevation and a gentle declivity. These hills, furrowed by streams of running water, often gradually slope away, and at last lose themselves in the plains. Sometimes, their sides are so rugged and precipitous as to produce on the mind almost all the picturesque effects of high mountains.

The peaks or higher parts of mountains formed by volcanic agency differ very much from the usual shape. Their conical or pyramidal masses are distinguished by their regularity, even when they have been broken off

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or truncated by some accidental cause. Their towering summits seem to menace the neighbouring country. The basaltic mountains also present an appearance not less striking when they are not covered and concealed by other soil. Their sides display to the view close ranges of immense pillars or causeways, which seem to be the productions of giants.

Single detached elevations of great height are rare, but mountains are generally found in lofty bands, consisting either of one central chain, with branches running off at right angles, or of several chains or ridges running parallel to each other; and, in both cases, often accompanied by subordinate chains of a smaller elevation. A group of mountains is a collection of several chains; a system of mountains is a collection of groups.

The most general view of mountain systems shows us a vast mountainous zone almost completely surrounding the basin of the great Pacific Ocean; rising from the southern extremity of South America, the lofty rampart of the Andes extends along the western coast of the American continent, at no great distance from the sea, through a length of 9,000 miles, and, sweeping round in a semicircle through Asia, a continuation of the same great barrier, under the various names of the Altai, Himalaya, and Taurus, crowns the summit of the declivity down which the great Asiatic rivers descend into the ocean. The Caucasian, the Carpathian, and the Alpine chains, are a prolongation through Europe of the colossal girdle.

The following is the height of the loftiest peaks in the different quarters of the globe.

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	Feet.
South America, (Andes, Nevado de Sorato,)	25,400
North America, (Mt. St. Elias,) . .	17,970
Europe, (Mont Blanc,)	15,732
Africa, (Abyssinian Mountains,) . .	14,720
Asia, (Himalaya,)	28,000
Oceanica, ...	15,125

In the benevolent purposes of Providence, these great elevations of the earth's surface are made subservient to the well-being of the animal creation. Rising into regions of perpetual ice, they serve in hot climates to cool the burning air, and to fan the panting inhabitants with refreshing breezes; they are the reservoirs of rivers, supplying their shrinking streams in the dry seasons of the lower countries with copious torrents from the melting snows; they are the storehouses of the richest minerals; they increase the surface of the earth, and give diversity and richness to its vegetable products; and how often have they not served to stay the march of the conqueror, and to shelter in their fastnesses the last champions of freedom!

Islands. — The Eastern and Western continents are, strictly speaking, two great islands, washed on all sides by the ocean; but, setting these aside under the name of continents, we generally restrict the application of the term islands to smaller masses of land lying in the midst of seas or lakes.

Islands are sometimes detached, but oftener collected into groups or archipelagos; in some cases they are little more than low sand-banks, ledges of rocks, or coral reefs, and in others, rising to a considerable elevation above the surface of the water, and, spreading to a con-

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siderable extent, they present in miniature all the features of the continents, — hills, valleys, plains, lakes, streams, &c.

They are often the summits of submarine mountainous chains, and as such are intimately connected with each other, and with the neighbouring continent; in general, they are considered as appendages to the nearest main land. Many of them are evidently the production of submarine volcanoes, which heave them up from the bosom of the waters, and fertilize their surface by the matter ejected from their bowels.

The largest islands of the globe are Borneo, New Guinea or Papua, Greenland, Sumatra, Madagascar, Niphon, Cuba, Great Britain, &c.

Caverns. — Caves or grottos are cavities of greater or less extent, which have been formed by different causes in the crust of the earth. They are either open to day, or are more or less completely concealed in the interior of the earth.

There are many different modes in which these wonders of nature are formed. Those in limestone and gypsum appear to have been produced by the dissolving power of water, which has thus hollowed out the rock, and carried off the dissolved materials. Those in lava and trachyte are produced by the expansive power of gases or vapors, operating upon the rocky mass in a state of fusion, or softened by heat. Others are the effect of rents in the crust of the earth, occasioned by earthquakes.

Stalactites and stalagmites are formed by the filtration of water containing calcareous matter through the pores or fissures in the roofs of limestone caverns.

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When the water deposits its lime, as it drops from the roof of the cavern, it forms long rods of stone, hanging down like icicles, which are called stalactites; but when the water falls to the floor, or trickles down the sides of the cavern, the calcareous crust formed by its evaporation is called a stalagmite. The masses thus produced, whether pendent from the roofs or rising from the floor, often assume shapes resembling objects of nature or art, and frequently give the cavern a highly brilliant appearance.

Caves of America. — The cave of Guacharo, near Caripe, in Venezuela, is so called from the vast flocks of nocturnal birds of that name which frequent it, and which are killed in great numbers for their fat. It is 85 feet broad and 77 high at its opening, and preserves these dimensions for the distance of about a quarter of a mile. A river issues from it, but it has never been explored.

Near the Duida Mountain, in the valley of the Orinoco, there is the vast cave of Ataruipe, remarkable as containing the skeletons of an extinct tribe of natives, and urns filled with bones, which have been prepared by drying in the sun, or by being besmeared with resins or some coloring matter.

Nickojack Cave, in the northwestern part of Georgia, which is 50 feet high by 100 wide, and is traversed by a stream of considerable size, has been explored to the distance of three miles.

Wyer's Cave, in Virginia, contains a series of large halls extending for the distance of half a mile, and adorned with glittering stalactites.

Mammoth Cave, in Edmonson county, Kentucky, is

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one of the largest that has been discovered; it extends ten or twelve miles, containing a great number of long passages and vast halls; one of these, called the Temple, is said to be eight acres in extent, with a roof 100 feet high, unsupported by a single pillar; from this numerous avenues lead to several other apartments little inferior in size. A large hotel has been built in this wonderful cave, and sixty persons sometimes may be seen dining there.*

CAVES IN EUROPE.—One of the most remarkable of these is Fingal's Cave, in the island of Staffa. Its entrance, 66 feet high by 42 wide, leads into a natural hall about 200 feet in length, which is bounded on all sides by regular columns of basalt. It was not discovered till 1772.

The Peak Cavern, near Castleton, Derbyshire, England, is a huge gulf, 42 feet high and 120 feet long, at the foot of perpendicular cliffs of amazing height. Thence the visiter is conducted through a succession of dark, cavernous apartments, and ferried along a subterraneous river, above which the rocks are so close, that he is obliged to lie flat on his face. This terminates at the distance of about 2,000 feet.

Poole's Hole, near Buxton, is chiefly remarkable for the large masses of stalactite and other petrifactions with which it is filled. It derives its name from its having been the retreat of a famous robber of the sixteenth century.

Baumann's Cave, in the Hartz Mountains, consists of a series of rooms, six in number, having a total length

* For a full description of this and other caves, see "Wonders of Geology."

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of 760 feet; and in the same region is Biel's Hole, formed of fifteen apartments, 650 feet in length.

Near Grenoble, in France, is the cave of our Lady of Balme, composed of several apartments, glittering with stalactites, resounding with cascades, and containing a subterranean lake which the visiter crosses by the glare of torches.

Among the thousand caves found in the mountains of the Austrian kingdom of Illyria, the Adelsberg is the most remarkable. It is stated to be five miles in length; it is a perfect labyrinth, composed of long, steep, and winding passages, terminating in lofty and spacious apartments, decorated with stalactites of the most fantastic and picturesque groupings, traversed by a boisterous torrent, whose tumultuous roarings are repeated by the echoes of the vaults, and containing great quantities of organic remains. Magdalen's Cave, in the vicinity, is less extensive but more lofty, and its stalactites resemble colossal caryatides, sustaining high arches.

The Grotto del Cane, or Dog's Cave, near Naples, is a small aperture, deriving its interest from the exhalations which issue from it, strongly impregnated with carbonic acid gas. It is usual to plunge a dog into this suffocating air for the amusement of visiters; on being withdrawn, the animal, which had become apparently lifeless, immediately recovers its powers.

The cave of Trophonius was celebrated among the ancients for its oracle; it was a small, deep hole, in Bœotia, down which the person consulting the oracle was obliged to descend, and in which he was subjected to a number of fatiguing and terrifying

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rites, as he usually returned pale and dejected, it became a proverbial expression in regard to a melancholy person, "He has just come from the cave of Trophonius."

The celebrated grotto of Antiparos, in one of the Grecian islands, is a spacious cave 350 feet long, 325 broad, and about 175 high, situated at the bottom of a succession of steep, winding galleries, near 1,500 feet below the surface of the ground. Colossal pillars of crystallized alabaster rise from the floor to the roof, and stalactites of the same substance hang like huge icicles from the roof, decorated with festoons, curtains, &c., of shining white rock and glittering crystals.

NATURAL BRIDGES. — Akin to these natural saloons, and often accompanying them, are the natural bridges formed by solid arches stretching over chasms, or by large masses of rock, which, having fallen into a cleft, have been arrested in the descent by the narrowness of the fissure, and have thus bridged over the otherwise impassable gulf.

The most remarkable of these are the natural bridges of Icononzo, near Bogota, in New Grenada; that of Rumichaca, near Pasto; that of the Ay, in Cuba; that of the Mother of God, in Mexico; the celebrated Rock Bridge of Virginia; the natural bridge of Veja, near Verona, &c.

The bridges of Icononzo extend over a crevice, at the bottom of which flows the torrent of Summa Paz; the upper bridge is a natural arch, 40 feet broad by 50 long, 318 feet above the stream; the lower is 64 feet beneath this, and is formed of three enormous blocks, which have fallen so as to support each other.

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The Natural Bridge of Virginia is 60 feet wide, 90 long, and 250 high, from the bottom of the fissure over which it extends.

Plains. — We give the name of plains to extensive tracts, whose surface is in the main level, or but slightly broken by gently swelling and subsiding eminences, or by inconsiderable and almost imperceptible depressions. They are found at all degrees of elevation above the sea, and of every stage of fertility, from the inexhaustible fecundity of the Egyptian Delta to the irreclaimable sterility of the sandy deserts.

America contains several vast plains. One of these extends from the shores of the Arctic Sea to those of the Gulf of Mexico, and from the Rocky Mountains to the Alleghanies; it embraces the valleys of the Mississippi, the St. Lawrence, the Nelson, the Churchill, and most of those of the Missouri, the Mackenzie, and the Coppermine, including an area of 3,240,000 square miles. Another great plain comprises the central part of South America, extending over an area of 3,000,000 square miles, including more than half of Brazil, the southern part of New Grenada, the eastern part of Ecuador and Peru, and the northern part of Bolivia; its moist and warm climate clothes it with a pomp and vigor of vegetation nowhere equalled. The plain of the Plata, extending from the mountains of Brazil to the Strait of Magellan, comprehends the whole of the southern part of South America east of the Andes, with an area of 1,620,000 square miles. The plain of the Orinoco, including the region extending from the Caqueta to the mouths of the Orinoco, has an area of 350,000 square miles. These two are distinguished

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from the great plain of the Amazons by the absence of trees, and the wide grassy tracts which cover their surface.

The most extensive plain on the surface of the globe is the vast tract stretching from the shores of the North Sea to the Pacific Ocean, and broken only by the Ural Mountains. It has an average breadth of 1,400 miles, and a length of 6,000, comprehending an area of 6,500,000 square miles. It comprises large heaths, sandy deserts, and steppes, or open pastures, but has few considerable forests.

TABLE LANDS. — Table lands, or plateaux, are elevated plains, forming in some instances the nucleus of the great masses of land above the general surface of which they rise. They often contain chains of mountains, plains, and valleys, and their declivities present to the inhabitants of the low countries at their feet the appearance of a long chain of mountains. The whole of Central Africa is supposed to be a vast table land, descending by successive terraces towards the coasts on all sides.

The interior of Asia is composed of a succession of these lofty plains, among which the following are the most remarkable; the Persian table land comprises nearly all the country south of the Caspian and Black Seas, from Asia Minor to the Indus, including Armenia, Georgia, Curdistan, Persia, Afghanistan, &c.; this region is from 2,500 to 6,000 feet above the sea; Zungaria and the adjacent region is from 2,000 to 2,500 high; Mongolia lies at an elevation of from 8,000 to 12,000 feet, and Thibet is still more elevated.

There are some masses of this kind in Europe, but

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of less extent; the central part of Spain is a lofty plain of about 2,200 feet in height, and between the Alps and the Jura is the Swiss table land, about 3,500 feet high.

One of the most remarkable of these masses is the Mexican table land, not less extraordinary for its extent than its elevation. On the eastern and western coasts are low countries, from which, on journeying into the interior, you immediately begin to ascend, climbing to all appearance a succession of lofty mountains. But the whole interior is in fact thus raised into the air from 4,000 to 8,000 feet. This conformation of the country has most important moral and physical results; for while it gives to the table land, on which the population is chiefly concentrated, a mild, temperate, and healthy climate, unknown in the burning and deadly tracts of low country into which a day's journey may carry the traveller, it also shuts out the former from an easy communication with the sea, and thus deprives it of ready access to a market for its agricultural productions. Carriages pass without difficulty on the summit of the table land for hundreds of miles, from Mexico to Santa Fe, but can descend to the eastern and western coasts only at a few points.

A large part of New Grenada and Ecuador is situated at an elevation of from 5,000 to 9,000 feet, and contains populous cities, such as Quito, Bogota, &c., 8,000 or 10,000 feet above the level of the sea.

Another of these table lands includes an extensive tract in Peru, Bolivia, and the States of the Plata, stretching from 6° to 26° S. Lat., and raised above the sea to the height of from 4,000 to 10,000 and even

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12,000 feet. These three great plateaux were each the centre of a native American civilization at the time of the discovery of the continent.

DESERTS. — Deserts are tracts of greater or less extent, utterly sterile, and incapable of supporting vegetable matter or animal life. These frightful solitudes, destitute of water or verdure, present plains of sand or shingle, interspersed with not less barren and arid heights, and exhibiting no indications of animated beings. In some, parched by a scorching sun, burning winds, charged with poisonous exhalations, and columns of moving sands, add to the horrors of the scene. Even these desert regions are, however, generally interspersed here and there with little fertile tracts, rising like green islands out of the sandy ocean, well watered and well wooded, and affording shade and refreshment to the exhausted traveller; these spots are called *oases* or *wadies*.

The most extensive of these desert tracts is the great sandy zone which stretches from the Atlantic Ocean across Africa and Central Asia nearly to the Pacific Ocean, or to 120° E. Lon. It includes nearly one fourth of the eastern continent through which it passes, covering an area of 6,500,000 square miles. Sahara or the Great Desert of Africa, Arabia, and the plateaux of Persia and Thibet, present the most continued surface of sand.

America is characterized by an almost entire absence of deserts, and it has been estimated that, although its surface is less than half of that of the Old World in extent, it contains at least an equal quantity of useful soil. The only true sandy deserts are that

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of Atacama, a belt of sand extending, with considerable interruptions, from the northern part of Peru to Copiapo in Chili, a distance of about 1,700 miles, with a width of from ten to fifty; and the Desert of Pernambuco which is also an arid waste of sand; but other tracts to which this name has been applied are, though incapable of culture, yet not destitute of vegetation.

Steppes, Pampas, Karroos, &c.—The surface of the earth contains several extensive tracts, which, although possessing a productive soil, are yet in their natural state entirely destitute of trees, and in general spread out into wide, unbroken plains. Such are the extensive open pastures of the great plain of Northern Europe and Asia, called steppes, the jungles of India, the karroos of Southern Africa, the prairies of North America, the llanos and pampas of South America, and the heaths of Europe.

While the whole Atlantic slope of North America south of the St. Lawrence, and the region west of the Rocky Mountains, were naturally covered with a dense forest, the great plain before described formed what Darby calls the grassy or prairie section, consisting chiefly of unwooded, but fertile plains, covered with a rich herbage, and affording immense natural pastures, though occasionally degenerating into bare and arid wastes. An extensive tract of several hundred miles in width, on the east of the Rocky Mountains, approaches to the character of a desert, and much of the northern part of the continent exhibits the same features.

In Venezuela, the wide plains called llanos are for half the year covered with a luxuriant verdure, but

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during the dry season become parched and burned so as to resemble sterile wildernesses.

The pampas, which occupy a large part of the plain of the Plata, are dotted here and there with palm groves, and in some places are overgrown with thistles, or incrusted with salt; but for the most part they are covered with rich herbage, feeding countless herds of cattle.

Some of the steppes of Asia are merely sandy plains, bearing a few stunted shrubs, and exhibiting only occasional spots of verdure; others are covered with herbage, and afford good pasturage for the numerous herds of the pastoral tribes that roam through them; others bear saline and succulent plants, or are coated with saline incrustations.

The karroos of Southern Africa are tracts of arid clay-land, bearing some succulent plants, but the meagre vegetation which clothes them with green, and adorns them with flowers, during the rainy season, disappears during the heats of summer, giving the country the aspect of a parched and barren plain.

The jungles of India are tracts covered with dense and impenetrable masses of vegetation, crowded and twined together, consisting of thorny and prickly shrubs of every size and shape, canes, which in a few months shoot up to the height of sixty feet, and creeping plants and bushes, and forming impassable barriers even to an army.

Valleys. — Valleys are the spaces lying between opposite ridges of mountains or hills, and their lowest part is commonly the bed of some torrent or river, which has its sources in the higher grounds. Those between high mountains are in general narrow and long, resembling large clefts or fissures.

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Some valleys, lying between opposite mountainous chains, are of great extent, comprising whole provinces or countries. Such are the great valleys of the Ganges in Asia, and of the Mississippi in North America. Some are situated far above the level of the ocean, although sunk deep below that of the adjoining country. Such are those of Chota, near Quito, which is 5,000 feet deep, and of Rio Catacu, in Peru, which is 4,000. Bootan, Thibet, and Nepaul, are deep valleys of Asia. Those of the Po, of Savoy, the Tyrol, &c., in Europe, are of less extent.

WATER SURFACE OF THE GLOBE.

Any definition of this element is unnecessary; but mankind must have remarked, at a very early period, that the waters distributed over the globe differ considerably in their fitness for drinking, for preparing food, and for other domestic purposes. These differences are occasioned by the foreign bodies which this liquid holds in a state of solution or suspension; for water is capable of dissolving a greater number of substances than any other fluid. Hence, it is scarcely ever found native in a state of absolute purity; in some cases the quantity of foreign matter is so minute as to have little influence on the taste, or other properties; but in other instances, they are so abundant as to render it unfit for common use, or even noxious; while, at other times, it is medicinal, according to

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the nature of the substances with which it is impregnated. Native water, free from color, is almost never poisonous, especially if it be at the same time tasteless; but if blue from copper, green from iron, or brown from vegetable impregnation, it is unfit for the use of man. Water performs the most important functions in the vegetable and animal kingdoms, and enters largely into their compositions as a constituent part.

This substance presents itself under three different forms of aggregation. If under sufficient pressure, it is liquid at all temperatures above 32°, so far as is known. It is the densest at the temperature of 40°. When cooled down to 32°, it ordinarily assumes the form of ice; but if great care be taken to avoid agitation, it may be cooled almost to zero without freezing. Congelation commences in the form of prismatic crystals, crossing each other at angles of 60° or 120°, and the temperature, however low before, instantly rises to 32°. During this process, the water expands with a prodigious force, the volume suddenly increasing about a ninth part. Glass bottles filled with water, and properly stopped, are burst during its congelation, and the same has happened to a strong bomb-shell. Water passes into vapor at all temperatures, and under any pressure; when the elasticity of the vapor equals or exceeds the incumbent pressure, the process proceeds with violence, and is called boiling. Under the ordinary pressure of the atmosphere, this takes place at about 212° of Fahrenheit's scale; but the boiling temperature varies with the pressure; hence water boils at a lower temperature on a mountain top, and at a higher in a deep pit.

The relations of water to heat are very remarkable.

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With the exception of hydrogen gas, it absorbs more heat in warming, and parts with more in cooling, than other bodies do. Hence large bodies of water have a powerful influence in checking or retarding sudden alterations of temperature in the surrounding air. Ice, in melting, absorbs as much heat as would raise its temperature 140°, and gives out the like quantity again in freezing,—a property that enables it to resist or retard sudden alterations of temperature in cold climates in a more remarkable degree than the other; which, however, exerts its influence in the torrid and temperate, as well as in the frigid zone. Lastly, water, in assuming the elastic form, absorbs heat sufficient to raise its temperature 1000°, and parts with as much in recondensing into water; so that water possesses an almost boundless influence in tempering climate.

Water, as to its composition, was long ranked among the simple elements; but the researches of modern chemistry have ascertained that it is a compound of 88.9 parts of oxygen, and 11.1 of hydrogen; or its composition by volume and weight may be thus stated: one volume of oxygen combined with two of hydrogen, or eight parts by weight of oxygen with one of hydrogen. It is composed and decomposed, during many of the operations of nature, and its chemical agency is almost universal. It is an ingredient in most bodies which appear under the crystalline form.

Rivers.—The origin and progress of rivers have been compared by Pliny to the life of man. "Its beginnings are insignificant, and its infancy is frivolous; it plays among the flowers of a meadow, it waters a garden, or turns a mill. Gathering strength in its

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youth, it becomes wild and impetuous. Impatient of the restraints which it still meets with in the hollows of the mountains, it is restless and fretful, quick in its turning, and unsteady in its course. Now it is a roaring cataract, tearing up and overturning whatever opposes its progress, and it shoots headlong down a rock; then it becomes a sullen, gloomy pool, buried in the bottom of a glen. Recovering breath by repose, it again dashes along, till, tired of uproar and mischief, it quits all that it has swept along, and leaves the opening of the valley strewed with the rejected waste. Now quitting its retirement, it comes abroad into the world, journeying, with more prudence and discretion, through cultivated fields, yielding to circumstances, and winding round what would trouble it to overwhelm or remove. It passes through the populous cities, and all the busy haunts of man, tendering its services on every side, and becomes the support and ornament of the country. Increased by numerous alliances, and advanced in its course, it becomes grave and stately in its motions, loves peace and quiet, and in majestic silence rolls on its mighty waters till it is laid to rest in the vast abyss."

The sun, moon, and the host of heaven, have, in all ages and nations, been objects of sincere worship. Next to them, the rivers seem to have attracted the grateful acknowledgments of the inhabitants of the neighbouring countries. They have everywhere been considered a sort of tutelar deitiès, and each little district, every retired valley, had its river god, who was preferred to the others. The expostulation of Naaman, the Syrian, who was offended by the prophet for enjoining him to wash in the River Jordan, was the natural effusion of this

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attachment. "What," said he, "are not Abana and Pharpar, rivers of Damascus, more excellent than all the waters of Judea? Might I not wash in them and be clean? So he went away wroth." In those countries, particularly where the labors of the husbandman and shepherd depended on what took place in a far distant country, by the falling of periodical rains, or the melting of the collected snows, the Nile, the Ganges, the Indus, were the sensible agents of nature in procuring to the inhabitants of their fertile banks all their abundance, and they became objects of grateful adoration. Their sources were sought for even by conquering princes, and when found were worshipped with the most affectionate devotion. These rivers preserve to this day the fond adoration of the inhabitants of the countries through which they pass, and their waters are still held sacred.

The general utility of rivers is no less obvious than their beauty. They carry the waters from the mountains and highlands to the plains below, and scatter fertility along their borders. They furnish the means of conveying the fruits of industry to the ocean, the great highway of nations, and of bringing back the varied productions of other climes. Their banks become the marts of commerce, and the seats of wealth and civilization.

The following table shows the length of some of the most remarkable rivers on the globe.

IN AMERICA.

	Miles.
Missouri, to the mouth of Mississippi,	3,500
Oregon, or Columbia,	1,200
St. Lawrence,	2,000

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	Miles.
Arkansas,	1,300
Rio Bravo del Norte,	1,250
Connecticut,	310
Hudson,	300
Delaware,	275

IN EUROPE.

Volga,	1,900
Danube,	1,630
Rhine,	890
Rhone,	540
Tagus,	520
Seine,	480
Po,	390
Thames,	240
Tiber,	210

IN AFRICA.

Nile,	2,750
Niger,	2,300
Congo,	1,400
Senegal,	850

IN ASIA.

Yenesei,	2,900
Yangste Kiang,	2,700
Obi,	2,800
Ganges,	1,350
Euphrates,	1,360
Ural,	1,050

CATARACTS.—When a river bed suddenly changes its level, so that the stream is plunged down a consider-

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able distance, a cataract, cascade, or fall is formed; when the change of the level is less abrupt, and the inclination is yet such as to render the current violent and broken, we give it the name of rapids.

Falls are generally formed by the descent of rivers or streams from primitive mountains to secondary countries; compact, durable rocks are requisite for producing a permanent effect of this kind; such are the cataracts of the Nile, the Ganges, and most other rivers.

Some cataracts, like those of Tunguska in Siberia, have gradually lost their elevation by the wearing away of the rocks over which they are precipitated, and have become merely rapids, and the same effect is produced in others by the gradual filling up of the gulf into which they plunge. "Cataracts," says Lamouroux, "must have been both more numerous and more lofty in the ancient world than they are at present. They are daily diminished both in number and height by the action of the universal leveller, time, and perhaps in some future age the cataracts of the Nile and the Ganges, the Falls of Niagara, and the cascades of Tequendama will be looked upon as a fiction of poetry."

Some of the most beautiful cataracts have been created, at least in part, by human labor. The celebrated *Cascata del Marmore* at Terni, "which," says Byron, "is worth all the cascades and torrents of Switzerland put together," is attributed to a work of Curius Dentatus, (270 B. C.,) who caused the rock to be cut through for the purpose of draining the marshes, and making an outlet for the Velino.

Some cataracts owe their celebrity to the vast vol-

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ume of water which is poured, in an unbroken sheet, over a great descent, as with Niagara; others are remarkable only for the vast height from which they fall, whether they plunge down the abyss at a single leap, or dash themselves successively from shelf to shelf till they reach the bottom of the precipice; some, falling in a small riband-like current over the edge of the rock, are dispersed before they reach the ground into thin spray, forming glittering showers of brilliants, or gaudy rainbows; others, driven forward by the force of the current, fall over in a continuous arch, between which and the bottom of the ledge from which they have fallen the visiter may pass; and yet others are visited and admired chiefly for the picturesque beauties of the glen, the grandeur of the precipices, or the gloomy horrors of the deep chasms which surround them.

"If it be difficult," says Humboldt, "to describe the beauties of cataracts, it is still more difficult to make them felt by the aid of the pencil. The impression they leave on the mind of the observer depends on the occurrence of a variety of circumstances. The volume of water must be proportioned to the height of the fall, and the scenery around must wear a wild and romantic aspect. The Pissevache and the Staubbach in Switzerland are lofty, but their masses of water are inconsiderable; the Niagara and the Falls of the Rhine on the contrary furnish an enormous column of water, but the height even of the former does not exceed one hundred and seventy feet. A cataract surrounded by hills merely produces much less effect than the waterfall which rushes into the deep and narrow val-

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leys of the Alps, and still more of the Andes. Independent of the height and body of the column of water, the figure of the landscape, and the aspect of the rocks, it is the luxuriant form of the trees and herbaceous plants, their distribution into groups or scattered thickets, the contrasts of the craggy precipices to the freshness of the vegetation, which give a peculiar character to these grand scenes of nature. The Niagara, which in a northern sky is in the region of oaks and pines, would be still more beautiful were its drapery composed of heliconias, palms, and arborescent ferns."

REMARKABLE FALLS IN EUROPE.

Name.	Height in feet.
Gavarnie, France, Pyrenees,	1,350
Fugloe, Isle of Fugloe, Norway,	1,000
Staubbach, Switzerland,	960
Doby Myllin, Wales,	900
Ginfael, Wales,	900
Riukan Fossen, Norway,	800
Holme's Fall, Scotland,	800
Nant d'Arpenaz, Savoy,	800
Nemelsaskas, or Lulea, Lapland,	600
Gray Mare's Tail, Scotland,	350
Pissevache, Switzerland,	300
Terni, or Velino, Roman States,	300
Acharn, Scotland,	240
Fyers, do.	212
Reichenbach, Switzerland,	200
Devil's Bridge, Switzerland,	100
Schaffhausen, do.	80
Tivoli, Roman States,	50

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REMARKABLE FALLS IN AMERICA.

Name.	Country.	Height in feet.
Tequendama,	New Grenada,	580
Pusambio, or Purace,	New Grenada,	400
Montmorency,	Canada,	250
Falling Spring,	United States,	200
Cauterskill,	do.	175
Niagara,	do.	170
Tauqkanic,	do.	160
Great Falls,	do.	150
Chaudière,	Canada,	100
Missouri,	United States,	90
Guanacualtan,	Mexico,	80
Passaic,	United States,	70
Cahoes,	do.	60
St. Anthony's,	do.	40
Glenn's,	do.	40

This is far from being a complete list even of the most remarkable waterfalls of these two continents; but it has been found quite impossible to give the dimensions of many striking cataracts, particularly in America, with any approach to accuracy; — nor have the highest known falls been mentioned here, because they are nothing more than the merest rills, and seldom offer any peculiar interest. Thus the little stream of Ache in Bavaria throws itself over an elevation of 2,000 feet, and there is said to be a cascade of equal height in the island of Nukahiva.

Remarable Falls in Asia. — Some of the most remarkable cataracts of Asia, with which we are acquainted, are the Fall of Garispa, in the Indian Ghauts, 1000 feet high; the Birra Chuki, 100 feet, and the

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Ganga Chuki, 200 feet, in the Cauvery; and those of Bilohi, 400, Chachai, 362, Tonse, 200, and Booti, 400 feet in height, in Bundelcund. There are many beautiful and magnificent cascades in the Ghauts, and the Ganges, Indus, and Brahmapootra exhibit many falls which have not been described.

The Cataracts of the Nile, so much celebrated by the ancients, have an elevation of not more than ten or twelve feet.

The Falls of Niagara have been found to be gradually receding from Lake Ontario; this great body of water is hurled over a ledge of hard limestone, below which is a layer of soft shale, which decays and crumbles away, so that the superincumbent limestone is left without a foundation, and falls from time to time in large masses. The bed of the river below the falls is strewed over with the huge fragments that have been thus detached and plunged into the abyss. Within the last forty years the Falls have receded nearly fifty yards, and there is little doubt that they were once at Queenstown, about seven miles below their actual site. Should they continue to recede at the rate above stated, or a little more than one yard annually, it will be 30,000 years before they reach Lake Erie.

The following beautiful description of this stupendous cataract, written by the late F. W. P. Greenwood, will be read with interest.

"There is a power and beauty, I may say a divinity, in rushing waters, felt by all who acknowledge any sympathy with nature. The mountain stream, leaping from rock to rock, and winding, foaming, and glancing through its devious and stony channels, arrests the eye

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of the most careless or business-bound traveller, sings to the heart and haunts the memory of the man of taste and imagination, and holds, as by some undefinable spell, the affections of those who inhabit its borders. A waterfall of even a few feet in height will enliven the dullest scenery, and lend a charm to the loveliest; while a high and headlong cataract has always been ranked among the sublimest objects to be found in the compass of the globe.

"It is no matter of surprise, therefore, that lovers of nature perform journeys of homage to that sovereign of cataracts, that monarch of all pouring floods, the Falls of Niagara. It is no matter of surprise, that, although situated in what might have been called, a few years ago, but cannot be now, the wilds of North America, five hundred miles from the Atlantic coast, travellers from all civilized parts of the world have encountered all the difficulties and fatigues of the path, to behold this prince of waterfalls amidst its ancient solitudes, and that, more recently, the broad highways to its dominions have been thronged. By universal consent, it has long ago been proclaimed one of the wonders of the world. It is alone in its kind. Though a waterfall, it is not to be compared with other waterfalls. In its majesty, its supremacy, and its influence on the soul of man, its brotherhood is with the living ocean and the eternal hills.

. . . . .

"From Waterloo we pass on by a level road, immediately on the western bank of the Niagara, and observe that the river continually becomes wider, till at length it divides into two streams, which sweep round

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an island several miles in length. They then unite again, forming one stream as before, only that it is increased in breadth and swiftness. And now the interest thickens, and begins to grow intense. Hitherto we had been travelling on the side of a large river, it is true, but one not much distinguished otherwise, either by its motion, its shape, or the beauty of its borders. We are obliged to call on ourselves to consider where we are, and whither we are going; for Niagara itself seems unconscious of the grand associations with which it is freighted. It moves as if unmindful, or as not caring to put the traveller in mind, that its waters have come down through the whole length of Erie from the far away Huron, Michigan, Superior; that they are just about to rush over the wondrous precipice below, and then are to hasten forward into another majestic lake, and from it are to pass through the portals of a thousand islands, and the alternate rapids and lakes of a noble and romantic river, washing the feet of cities, and so to flow on into the all-receiving sea. We are obliged to remember this, I say; for the unpretending waters, though pressing forward continually and intently, have thus far told us nothing, themselves, of their long pilgrimage behind, or the yet more eventful journey before them. But here, as they are meeting round Grand Island, they break their silence and speak, and the whole scene becomes full of spirit and meaning. Here, about three miles from the Falls, you see the white-crested rapids tossing in the distance before you. Here, even in the most unfavorable state of the weather, you hear the voice of the cataract, pervading the

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air with its low, monotonous, continuous roar. And here you see a column of mist rising up, like a smoke in distantly burning woods, and designating the sublime scene over which it is immediately hanging. I know not that I was afterward more strongly affected, even by the Falls themselves, than I was by the sight of this ever changing and yet never absent guide, this cloudy pillar, this floating, evanescent, and yet eternal testimony, which pointed out to me the exact spot which had been for so many years a shrine to thousands, which I had heard of and read of so long, and which I had myself so often visited, though not in person, yet with my reverential wishes, with my mind, and with my heart. Childhood came back to me, with its indistinct, but highly wrought and passionate images; maps were unrolled; books were opened; paintings were spread; measurements were recalled; all the efforts which the art of man had made, all the tributes which his spirit had offered, at the call of the great cataract; all these associations, with other dream-like thoughts of the wilderness, the lake, and the stream, rose up unbidden and with power within me, as I steadfastly regarded that significant, far-off mist, and knew that I, too, was soon to stand on the consecrated spot, and see, and feel.

"A mile or two is soon passed, and now we turn a little from the road to the right, in order to have a near view of the rapids. These occupy the whole breadth of the river, from shore to shore, and extend half a mile back from the Falls, and are formed by the rush of the entire body of waters down a rough bed, the descent of which in the course of this half mile is

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fifty feet. Here all is tumult and impetuous haste. The view is something like that of the sea in a violent gale. Thousands of waves dash eagerly forward, and indicate the interruptions which they meet with from the hidden rocks by ridges and streaks of foam. Terminating this angry picture, you distinguish the crescent rim of the British Fall, over which the torrent pours, and disappears. The wilderness and the solitude of the scene are strikingly impressive. Nothing that lives is to be seen in its whole extent. Nothing that values its life ever dares venture it there. The waters refuse the burden of man, and of man's works. Of this they give fair and audible warning, of which all take heed. They have one engrossing object before them, and they go to its accomplishment alone.

"Returning to the road, we ride the last half-mile, ascending gradually, till we come to the public house. A footpath through the garden at the back of the house, and down a steep and thickly wooded bank, brings us upon Table Rock, a flat ledge of limestone, forming the brink of the precipice, the upper stratum of which is a jagged shelf, no more than about a foot in thickness, jutting out over the gulf below. Here the whole scene breaks upon us. Looking up the river, we face the grand crescent, called the British or Horseshoe Fall. Opposite to us is Goat Island, which divides the Falls, and lower down to the left is the American Fall. And what is the first impression made upon the beholder? Decidedly, I should say, that of beauty; of sovereign, majestic beauty, it is true, but still that of beauty, soul-filling beauty, rather

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than of awful sublimity. Every thing is on so large a scale; the height of the cataract is so much exceeded by its breadth, and so much concealed by the volumes of mist which wrap and shroud its feet; you stand so directly on the same level with the falling waters; you see so large a portion of them at a considerable distance from you; and their roar comes up so moderated from the deep abyss, that the loveliness of the scene, at first sight, is permitted to take precedence of its grandeur. Its coloring alone is of the most exquisite kind. The deep sea-green of the centre of the crescent, where it is probable the greatest mass of water falls, lit up with successive flashes of foam, and contrasted with the rich, creamy whiteness of the two sides or wings of the same crescent; then the sober gray of the opposite precipice of Goat Island, crowned with the luxuriant foliage of its forest trees, and connected still further on with the pouring snows of the greater and less American Falls; the agitated and foamy surface of the waters at the bottom of the Falls, followed by the darkness of their hue as they sweep along through the perpendicular gorge beyond; the mist, floating about, and veiling objects with a softening indistinctness; and the bright rainbow which is constant to the sun, — altogether form a combination of color, changing, too, with every change of light, every variation of the wind, and every hour of the day, which the painter's art cannot imitate, and which nature herself has perhaps only effected here.

"And the motion of these Falls, how wonderfully fine it is! how graceful, how stately, how calm! There is nothing in it hurried or headlong, as you

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might have supposed. The eye is so long in measuring the vast, and yet unacknowledged height, that they seem to move over almost slowly; the central and most voluminous portion of the Horseshoe even goes down silently. The truth is, that pompous phrases cannot describe these Falls. Calm and deeply-meaning words should alone be used in speaking of them. Any thing like hyperbole would degrade them, if they could be degraded. But they cannot be. Neither the words nor the deeds of man degrade or disturb them. There they pour over, in their collected might and dignified flowing, steadily, constantly, as they always have been pouring since they came from the hollow of His hand, and you can add nothing to them, nor can you tak any thing from them.

"As I rose, on the morning following my arrival, and went to the window for an early view, a singular fear came over me that the Falls might have passed away, though their sound was in my ears. It was, to be sure, rather the shadow of a fear than a fear, and reason dissipated it as soon as it was formed. But the bright things of earth are so apt to be fleeting, and we are so liable to lose what is valued as soon as it is bestowed, that I believe it was a perfectly natural feeling which suggested to me for an instant, that I had enjoyed quite as much of such a glorious exhibition as I deserved, and that I had no right to expect that it would continue as long as I might be pleased to behold. But the Falls were there, with their full, regular, and beautiful flowing. The clouds of spray and mist were now dense and high, and completely concealed the opposite shores; but as the day advanced, and the

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beams of the sun increased in power, they were thinned and contracted. Presently a thunder-shower rose up from the west, and passed directly over us; and soon another came, still heavier than the preceding. And now I was more impressed than ever with the peculiar motion of the Fall; not, however, because it experienced a change, but because it did not. The lightning gleamed, the thunder pealed, the rain fell in torrents; the storms were grand; but the Fall, if I may give its expression a language, did not heed them at all; the rapids above raged no more and no less than before, and the Fall poured on with the same quiet solemnity, with the same equable intentness, undisturbed by the lightning and rain, and listening not to the loud thunder.

"About half a mile below the Horseshoe Fall, a commodious road has lately been cut in a slanting direction, down the side of the perpendicular cliff, and through the solid rock, to the river. Here we find a regular ferry, and are conveyed in a small boat across the stream, which is now narrowed to a breadth of about twelve hundred feet, to the American side. The passage is perfectly safe, and, though short, delightful, as it affords a superb view of both the Falls above, and of the dark river below. The current is not very rapid, and near the American side actually sets up toward the Falls; by the help of which eddy the boat regains what it had lost in the middle of the stream. We land almost directly at the feet of the American Fall, and by walking a little way to the right, may place ourselves in its spray. Now look up, and the height will not disappoint you. Now attend to the

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voice of the cataract, and it will fill your soul with awe. It seems as if the 'waters which are above the firmament' were descending from the heights of heaven, and as if 'the fountains of the great deep were broken up' from below. The noise, which permits free conversation to those who are on the bank above, is here imperative and deafening. It resembles the perpetual rolling of near thunder, or the uninterrupted discharge of a battery of heavy ordnance, mingled with a strange crashing and breaking sound. This resemblance to the roar of artillery is heightened by the sight of the large bodies of spray, which are continually and with immense force exploded from the abyss. The impression of superior height is gained, not so much from the fact that the American Fall is actually ten or twelve feet higher than the British, as from your having a complete *profile* view of the one, from brink to base, which you cannot well obtain of the other.

"Flights of secure wooden steps bring us to the top of the bank, where we again stand on a level with the descending Falls. We soon found that the greatest variety of interest was on this, the American side. The village of Manchester is situated on the rapid, just above the Fall. A bridge is thrown boldly over the rushing and 'arrowy' rapid to a small island, called Bath Island, where there are one or two dwellings and a paper-mill; and from this spot another bridge runs with equal boldness to Goat Island. The whole breadth of the space thus traversed is one thousand and seventy-two feet.

"Goat Island is a paradise. I do not believe that

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there is a spot in the world, which, within the same space, comprises so much grandeur and beauty. It is but about a mile in circumference, and in that mile you have a forest of tall old trees, many of them draped with climbing and cleaving ivy; a rich variety of wild shrubs and plants; several views of the rapids; an opportunity to pass without discomfort under the smaller American Fall, and the very finest view, I will venture to say, of the great Crescent, or Horse-shoe Fall. Turn to the left, as you enter this Eden, and you come out into a cleared and open spot, on which you discern a log-hut, with vines round its door and windows, and a little garden in front of it, running down to the water's edge; a flock of sheep feeding quietly, or reposing pleasantly, under scattered clumps of graceful trees; while, beyond this scene of rural repose, you see the whole field of the rapids, bearing down in full force upon this point of their division, as if determined to sweep it away. Or, turn to the right, and threading the shady forest, step aside to the margin of the smaller American Fall, and bathe your hands, if you please, in its just leaping waters. Then, pursuing the circuit of the island, descend a spiral flight of stairs, and, treading cautiously along a narrow footpath, cut horizontally in the side of the cliff, enter the magnificent hall formed by the falling flood, the bank of which you have just left, and command your nerves for a few moments, that, standing as you do about midway in the descent of the Fall, you may look up, eighty feet, to its arched and crystal roof, and down, eighty feet, on its terrible and misty and resounding floor. You will never forget that sight and sound.

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"Retrace your steps to the upper bank, and then, if your strength holds out, proceed a short way further, to the enjoyment of a view, already referred to, which excels every other in this place of many wonders. It is obtained from a bridge or platform, which has recently been thrown out over some rocks, and is carried to the very brink of the Horseshoe Fall, and even projects beyond it; so that the spectator, at the end of the platform, is actually suspended over it. And if he is alone, and gives way to his feelings, he must drop upon his knees, for the grandeur of the scene is overpowering. The soul is elevated, and at the same time subdued, as in an awful and heavenly presence. Deity is there. The brooding and commanding Spirit is there. 'The Lord is upon many waters.' The heights and the depths, the shadows and the sunlight, the foam, the mist, the rainbows, the gushing showers of diamonds, the beauty and the power and the majesty all around and beneath, environ the spirit with holiest influences, and without violence compel it to adore. 'Deep calleth unto deep.' The cataract, from its mysterious depths, calleth with its thunder, back to the deep lake, and up to the deep sky, and forward to the deep ocean, and far inward to the deep of man's soul. And the answer of the lake, and the answer of the sky, and the answer of the ocean, are praise to the Maker, praise to Him who sitteth above the waterflood, praise to Amighty God! And where is the soul, which will not also hear that call, and answer it even with a clearer and louder answer, and cry, 'Praise to the Creator, praise to the infinite and holy and blessed God!'"

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Springs. — These are formed by the percolation of waters through the earth and rocks, which descend from higher to lower levels, and flow out at openings which they find or force for themselves. They are almost all impregnated with some foreign ingredients, which render them more agreeable to the taste, and more nutritious, than pure rain-water. But it is only those waters which contain such a portion of foreign matter as gives them a sensible flavor, and a specific action upon the animal economy, to which we give the name of mineral waters.

The number of metals, earths, acids, and alkalis, held in solution by different springs, comprehends almost all known substances; but the most common and abundant are lime, iron, magnesia, silica, alumine, soda, and the carbonic and sulphuric acids.

Mineral springs are divided, in respect of temperature, into the cold and the thermal or warm springs. In regard to their ingredients, they are commonly divided into four classes; the acidulous or carbonated; the saline; the chalybeate or ferruginous; and the sulphureous.

Those waters which contain carbonic acid in its free state, or in combination in excess with a base, are called acidulous or carbonated waters. They are distinguished by their slightly acid taste, and by their sparkling when they are poured from one vessel to another; both of which properties they lose on exposure to the air. Beside carbonic acid they generally contain common salt, and some of the earthy carbonates.

To this class of waters belong those of Vichi and Mont d'Or in France; the famous Seltzer waters of

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Niederselters, in Nassau; the Carlsbad Springs in Bohemia; the Sweet Springs in Monroe county, Virginia, &c.

The sulphureous waters are impregnated with sulphuretted hydrogen. They are distinguished by their odor, and by their causing a piece of silver immersed in them to turn black. Beside sulphuretted hydrogen, they contain alkaline and earthy sulphates and muriates, and they may be subdivided into two kinds; those which have sulphuretted hydrogen in a free state, and those in which it is combined with an alkali or an earth. The general effects of these waters are stimulant, and they are more often used in the form of a bath than internally. They are serviceable in gout and rheumatism, in sprains and bruises, in cutaneous disorders, &c.

Among the sulphureous springs may be mentioned those of Aix-la-Chapelle, in Rhenish Prussia; of Enghien, in France; of Harrowgate, in England; of Moffat, in Scotland; the White Sulphur Springs of Greenbrier county, the Red Sulphur of Giles county, and the Salt Sulphur of Monroe county, Virginia; the Olympian Springs and the Blue Licks, in Kentucky, &c.

Chalybeate waters contain iron, and are known by their peculiar taste, and by their becoming black when mixed with an infusion of nutgalls. In some, the iron is combined with sulphuric acid, in more with carbonic acid; when this is in excess, the waters possess acid properties, and form acidulous chalybeate waters.

Chalybeate waters are tonic and aperient, and are used with advantage in cases of debility and chronic diseases. Among the most noted springs of this class

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are those of Tunbridge and Brighton, in England; of Spa, in Belgium; of Pyrmont, in Waldeck; the fourteen springs of Langenschwalbach, in Nassau; the springs of Ballston; Bedford, York, and Brandywine Springs, in Pennsylvania; the Yellow Spring, in Ohio, &c.

Saline waters are those which contain the saline ingredients generally found in mineral waters, but which have very little or no iron or sulphuretted hydrogen, and have not carbonic acid in excess. These are subdivided into alkaline, containing alkali in a free state, or combined with carbonic acid; hard waters, or those which contain carbonate or sulphate of lime; salt waters, in which salt abounds; and purgative waters, which contain chiefly sulphate of magnesia, or Epsom salt.

The most celebrated thermal saline waters are those of Bath, Buxton, and Bristol, in England; of Dunblane and Pitcaithley, in Scotland; Plombieres and Bourbon-Lancy, in France; Carlsbad and Teplitz, in Germany; Lucca and St. Julian, in Italy; and the Warm Springs of North Carolina.

Among the cold saline springs are those of Saratoga, in New York, and of Harrodsburg and Grenville, in Kentucky; Epsom and Cheltenham, Leamington, Scarborough, and Malvern, in England; and Sedlitz and Seidschutz, in Bohemia. When there is a considerable quantity of carbonic acid, they become more grateful to the taste, and when iron is present, as is sometimes the case, they acquire tonic and stimulant powers.

Thermal waters include individual springs of all the classes; a thermal spring being one which, whatever are its chemical properties, possesses a temperature more or less elevated above that of the region in

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which it is situated, and the changes of which do not coincide with those of the external atmosphere.

TABLE OF THERMAL WATERS.

Name.	Country.	Temperature.
San Pedro Dosal,	Portugal,	154°
Chaves,	"	142
Vic,	France,	212
Vichi,	"	115
Bourbon les Bains,	"	156
Teplitz,	Austria,	113
Carlsbad,	"	165
Wisbaden,	Nassau,	158
Schlangenbad	"	86
Aix-la-Chapelle,	Prussia,	136
Baden,	Baden,	154
Piscarelli,	Naples,	200
Geyser,	Iceland,	212
Buxton,	England,	82
Bristol,	"	74
Bath,	"	117
St. Michael,	Azores,	208
Hot Springs,	Arkansas,	212
Hot Springs,	Virginia,	112
Warm Springs,	North Carolina,	104
Sweet Springs,	Virginia,	73
Sans Souci,	New York,	50
Chichimaquillo,	Mexico,	205
St. Lucia,	West Indies,	203
Eaux Bouillantes,	Martinique,	131
Onoto,	Venezuela,	112
Trincheras,	"	195
Cuenca,	Equator,	162

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LAKES. — A lake is an inland body of water not connected with the ocean or any of its branches. In regard to the position of their beds, there are two classes of lakes; those formed in deep hollows among the mountains, and fed by springs or torrents; and those formed in level countries by the surplus water of rivers or in consequence of the want of a general declivity in the ground. Thus there is a system of the former class in the great Alpine girdle of the old continent, including the lakes of the Pyrenees, the Alps, the Apennines, and those of the Taurus, Caucasus, and Altaic chains; to the north of this great mountain band are the numerous lakes of the vast Northern plain of Europe and Asia, belonging to the latter class, and comprising the numerous lakes of Prussia, Sweden, Russia, and Siberia; to the south of the mountainous zone, in Africa, for instance, the lakes are few.

There is a similar disposition in the New World; a chain of mountain lakes accompanies the Andes through their whole course, including Titicaca, Nicaragua, Chapala, the small lakes of the Mexican valley, Timpanogos, &c., and while the great eastern plains of South America are nearly destitute of them, the regions around the Hudson contain an astonishing number of lakes, corresponding in number, character, and geographical situation to those which skirt the shores of the Baltic and the Frozen Ocean.

Another division of lakes is founded upon the manner in which they receive or discharge their waters, and in this point of view they form four classes: — 1. Those which receive streams of water, and have an outlet to the ocean are the most numerous and extensive. 2. Those which receive rivers, without having any visi-

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ble outlet, such as the Caspian Sea, Lake Tchad, in the interior of Africa, &c. 3. Those which receive no running water, but have an outlet; these are fed by springs. 4. Those which neither receive running water, nor have an outlet; these are small.

Lakes are also distinguished, according to the quality of their water, into saline and fresh; those which have no outlet, and those situated in a region, whose soil is impregnated with salt, are of the latter class.

EUROPEAN LAKES.

	Sq. Miles.		Sq. Miles.
Ladoga, (Russia,)	6,350	Lake of Constance,	290
Wener, (Sweden,)	2,150	Lake of Ilmen,	275
Saima, (Finland,)	1,610	Garda,	180
Peipus, (Russia,)	850	Maggiore,	150
Wetter, (Sweden,)	850	Neufchatel,	115
Mæler, "	760	Lucerne,	100
Lake of Geneva,	340		

ASIATIC LAKES.

Aral,	9,930 (?)	Van,	1,960
Baikal,	7,540 (?)	Urmiah,	760
Palkati,	3,696	Dead Sea,	500

AFRICAN LAKES.

Lake Tchad,	(?)	Dembea,	(?)
Maravi,	(?)	Dibbie,	(?)

AMERICAN LAKES.

Superior,	35,000	Athabasca,	6,000
Huron,	20,000	Erie,	10,000
Great Bear Lake,	(?)	Ontario,	7,200
Winnipeg,	10,000	Titicaca,	6,500
Slave Lake,	12,000	Nicaragua,	5,000
Michigan,	16,000		

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The following lines, descriptive of the largest mass of fresh water in the world, may serve to direct the attention of the reader to this sublime and beautiful object, in the scenery of our own continent: —

LAKE SUPERIOR.

Father of lakes! thy waters bend
Beyond the eagle's utmost view,
When, throned in heaven, he sees thee send
Back to the sky its world of blue.

Boundless and deep, the forests weave
Their twilight shade thy borders o'er,
And threatening cliffs, like giants, heave
Their rugged forms along thy shore.

Pale Silence, 'mid thy hollow caves,
With listening ear in sadness broods,
Or startled Echo o'er thy waves
Sends the hoarse wolf-notes of thy woods.

Nor can the light canoes, that glide
Across thy breast like things of air,
Chase from thy lone and level tide
The spell of stillness, deepening there.

Yet round this waste of wood and wave,
Unheard, unseen, a spirit lives,
That, breathing o'er each rock and cave,
To all a wild, strange aspect gives.

The thunder-riven oak, that flings
Its grisly arms athwart the sky,
A sudden, startling image brings
To the lone traveller's kindled eye.

The gnarled and braided boughs, that show
Their dim forms in the forest shade,

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Like wrestling serpents seem, and throw
Fantastic horrors through the glade.

The very echoes round this shore
Have caught a strange and gibbering tone,
For they have told the war-whoop o'er,
Till the wild chorus is their own.

Wave of the wilderness, adieu!
Adieu, ye rocks, ye wilds and woods!
Roll on, thou element of blue,
And fill these awful solitudes!

Thou hast no tale to tell of man, —
God is thy theme. Ye sounding caves, —
Whisper of Him, whose mighty plan
Deems as a bubble all your waves!

THE OCEAN. — This may be described as a sheet of water, resting in the hollows of the solid structure of our planet, and covering not less, probably, than two thirds of the entire surface. From calculations, its greatest depth is believed to be about 30,000 feet, or between four and five miles, which, it may be remarked, is near the greatest height of any land above the surface of the ocean. But the greatest depth which has been ascertained by actual measurement is not more than 5000 feet; for such is the pressure and density of the liquid mass at that depth, that no sounding-lead, or apparatus possessed by mariners, can possibly be made to sink below that point from the surface.

The quantity of water composing the ocean, by the unalterable laws of evaporation and condensation, remains always at a fixed point, there being neither increase nor decrease. It has been remarked by Laplace, that

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if the existing waters of the ocean were increased only one fourth, the earth would be drowned, with the exception of some of the highest mountains; and that if, on the other hand, the waters were diminished in the same proportion, the largest rivers would dwindle to the capacity of brooks, and some of the principal arms of the sea would entirely disappear, while at the same time the earth would be deprived of its due proportion of humidity, and the face of nature be dried up and rendered desolate. Broad, therefore, as are the limits of the ocean, they are only in exact agreement with the wants and arrangements of nature in the habitable portion of the globe, and as such afford a convincing testimony of the power, wisdom, and goodness of the Divine Creator.

The bottom or bed of the ocean is marked by the same irregularities of surface as the dry ground. It consists of heights and hollows, rocky protuberances and caverns, hills and vales, sandbanks and reefs, of every imaginable form and extent. Like the land, also, it bears a luxuriant vegetation, consisting of plants of various kinds, all of which are exactly suited to their respective situations. The sea has likewise its tribes of animals, from the huge whale down to the minute coral insect, by whose incessant labors the hardest rocky substances are constructed and reared to the surface of the waters. When the more elevated protuberances in the bed of the ocean are raised above the surface level, they assume, as is well known, the character of islands, and when of a large size, of continents. Thus, the tracts of dry land are in one sense the tops of mountains rising from the bosom of the deep. How islands

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are formed, sometimes by the action of volcanoes bursting upwards in showers of lava in the midst of the sea, and sometimes by the gradual accumulation of matter deposited by coralline insects; and also how tracts of land are added to continents, and also sometimes taken from them, by the influence of currents, rivers, and other natural causes, are explained by geology.

TIDES. — The waters of the sea may exhibit to the eye a calm, unruffled surface, when not agitated by winds, but they are never altogether still. Their ceaseless motion, which has the important effect of preserving them from stagnation, is caused by two great risings and depressions, or flowings and ebbings, of the waters, in the course of twenty-four hours, known by the name of tides. The two tides or flowings of the sea are experienced daily all over the globe, though in some seas, from peculiar local causes, they are less powerful than in other places. It is not a little remarkable, that the condition of high water or full tide occurs at directly opposite sides of the earth at the same time. When it is high water at longitude 0, it is also high water at longitude 180, and so on with every other two opposite points of the earth, on the same parallel of latitude.

It has been ascertained, beyond all reasonable doubt, that the tides are caused by the attractive influence of the moon. By the universal law of attraction or gravitation, all masses of matter have a tendency to be attracted or drawn towards each other. The moon, therefore, as a mass of matter, in passing round the earth, has a tendency to draw the earth after it, or out of its natural relative position, and it really does so to a small extent. As it passes round, it draws up the

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waters in a protuberance, or, in common language, draws a huge wave after it. But it also draws the land beneath the protuberance, and so causes the opposite side of the globe to be drawn away from the ocean, leaving the waters there to form a similar protuberance, or high wave. In the one case, the water is drawn directly up or towards the moon; in the other, the water is in some shape left behind by the land being pulled away from it. In both, a similar effect is produced; two high tides are caused at opposite extremities of the earth. Where the higher part of either of these great billows strikes our coast, we have the phenomenon of high water; and when the lower touches us, it is low water. Each of the waves is brought over any given place in the circumference of the earth in twenty-four hours, so as to cause high water twice a day. The sun is also known to have a certain attractive influence on the waters of the ocean, but, from the great distance of that luminary, the effect is comparatively small. But when this minor influence of the sun coincides with that of the moon, or acts in the same way, we perceive a marked increase in the tides; on such occasions we have what are called *spring* or *large* tides. When the solar and lunar attractions act in opposition, we have *neap* or *small* tides. The spring tides happen twice a month, when the moon is at full and change; and the neap when the moon is in the middle of its orbit, between those two points.

A tide requires six hours to rise, which it does by small impulses or ripplings of the water on the shore, and six hours to ebb or fall; but every successive high water is from twenty to twenty-seven minutes later than

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the preceding, or, on an average, about fifty minutes for two tides, in consequence of the earth requiring that time above the twenty-four hours to bring any given point again beneath the moon. The tides are thus retarded by the same reason that the moon rises fifty minutes later every day. It is evident that the tides will be greatest at that point of the earth's surface which is nearest to the moon, or where the latter is vertical. She is so between the tropics; and accordingly the tides are there greatest, and they diminish as we approach either pole. It is further to be remarked, that the moon does not anywhere draw up the tides immediately. Three hours elapse before the waters are raised, in consequence of the law of *inertia*, or a disposition which every body has to continue in the condition of rest or motion in which it happens to be placed. This stubbornness to resist the moon's influence is only overcome by a three hours' action upon the waters; and thus the tidal wave is always three hours behind the moon in its passage.

Twice a year, namely, in March and September, the tides are higher than at other times, because then the attraction of the sun and moon are strongest. In some of the friths or arms of the sea on the east coast of Scotland, it has been occasionally noticed that there have been four high waters in the twenty-four hours. These, however, are not simple tides. The double risings are caused by the irregular passage of the tidal wave from the Atlantic round the north and south points of the island of Great Britain. When that portion of the wave which proceeds by the south reaches the east coast sooner than that by the north, or *vice versâ*, there will

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be two risings of the water instead of one. Similar phenomena may be observed in other parts of the earth. In the Mediterranean Sea the tides are small, and in some places scarcely perceptible; this is caused by the general confinement of that inland branch of the ocean by the Straits of Gibraltar, which prevent the full action of the tidal wave either in its rising or recession.

CURRENTS. — Besides being affected by the regular motion of the tides, the ocean, in many parts of its extended bounds, is influenced by currents, which act continually in particular directions. Currents are the result of various causes, such as temperature, winds, peculiar construction of coasts and inlets, but chiefly, as is believed, of the rotary motion of the earth. The globe in its diurnal motion leaves, as it were, the fluid behind; and hence there is a perpetual flow of the sea from the western coast of Europe and Africa towards the eastern *landboard*, as it is called, of America, and from the west of America to the eastern coast of Asia.

This movement is chiefly confined to the tropics, unless where the sea is turned aside by the land, and caused to diverge towards the north or south. If we start, in a survey of this motion, from the western coast of America, we find it producing a constant current across the vast expanse of the Pacific, till it is turned off by Asia and Australia. A great division of its force is directed through the seas on both sides of the latter continent, and so on through the Indian Ocean, and round the Cape of Good Hope, till it reaches the free expanse of the Atlantic, across which it proceeds in the same manner as across the Pacific. The current

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of the Atlantic strikes the coast of Brazil, and breaks at Cape St. Augustine into two divisions, one of which proceeds round Cape Horn into the Pacific, while the other advances through the Caribbean Sea, and so on into the Gulf of Mexico. This latter branch conspires, with the vast issue of fresh waters which pours into the Gulf of Mexico, to raise the level of that sea above that of the neighbouring ocean, and, causing the surplus to force its way out between Florida and Cuba, produces the celebrated Gulf Stream, which is perhaps the most powerful sea current in the world.

It is obvious, that to the mariner currents must be of great importance. From Portugal, for instance, ships have sailed to the Bight of Benin, on the Guinea coast, being 150 leagues, in two days, though they could not return in less than seven weeks. It is also common for vessels to descend to the latitude of the Canary Islands, in order to get into the tropical current across the Atlantic, which carries them to America in a comparatively short time: it was by this current that Columbus was carried so smoothly on in his first voyage to the new continent. The Pacific, it is said, can be crossed in this way in about ten weeks, being at the rate of a thousand miles per week; and some mariners have expressed an opinion that China might be reached by this route in less time than by the shorter course round the Cape of Good Hope.

For the same reason that the sea flows from east to west, the air has a tendency, when not counteracted by other causes, to move in the same direction. The earth in its motion leaves the air, like the sea, a little behind it; in other words, does not carry it so fast for-

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ward: hence what are called the trade winds, which, operating in the same direction with the sea currents, increase the facility of navigation to the westward in a very great degree. It is impossible to avoid remarking, that these natural phenomena, which, it is to be supposed, might have been counteracted or neutralized from the beginning, must have been designed for some end useful and necessary in the economy of the world. Perhaps, like the diffusive powers given to the seeds of certain plants, they were intended to aid in the dispersion of the human race over the globe. It is well known that population exists in many places, which appear cut off from all connection with others by seas that must have been impassable by navigators in the early ages of their art. Men could only be drifted to such places in early ages by the currents of the sea and air; and thus the cultivation of large and important regions must have commenced much earlier than would have otherwise been the case.

Besides the grand equatorial or tropical current, there is one of a less decided character from the poles to the equator. The sea under the tropics evaporates to a greater extent than elsewhere, by the influence of a vertical sun. The vapors are apt to proceed towards the north and south, where they descend in rain. A surplus of water is thus produced in the high latitudes, which naturally flows back towards the equator. Hence a constant but comparatively slight flow from the north and south towards that warmer region of the earth. Under the influence of this stream, large masses of ice are constantly becoming detached from the polar stores, and drifted to the tropics. In some of the bays on the

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north side of Iceland, this frigid substance comes in vast quantities, insomuch as to choke them up to the depth of 500 feet. What is still more strange, these masses of ice are sometimes mixed up with trees, some of which are known to be the produce of the torrid zone in America: this is accounted for by the action of the northern division of the great current which parts at Cape St. Augustine. That division, after rushing into and out of the Gulf of Mexico, proceeds northward to Newfoundland, and thence at a high latitude returns athwart the Atlantic, finally sweeping along the western coasts of Europe, and rejoining the current which gave its first impulse. By this current, it is supposed, American timber may easily be carried to the northern shores of Iceland.

The operation of the tides is less observable in the great currents we have alluded to, than in those which prevail in the more secluded seas. The abstraction of water from a secluded sea by the recess of the tide, and the rush inwards produced by its flow, are sufficient of themselves to cause very impetuous currents, more particularly in the narrow channels by which the inland seas are connected with the ocean. We find it stated, in a pamphlet respecting the condition of the Orkney Islands, that the Pentland Frith, which separates the continent of Great Britain from Orkney, "has no fewer than four-and-twenty contrary currents of the tide at the flood of spring, besides numerous sets and eddies, which, under the local names of *wells*, *swelches*, and *roosts*, boil more madly on the Orcadian shore, than ever did witch's caldron on the kindred coast of Norway, if we may believe old tradition and Bishop

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Pontoppedan. 'The Boar of Papa,' at the opposite extreme of Orkney, is another terrible tide; when he gets a vessel in his tusks, he shakes the masts out,—an operation which, in the country phrase, goes by the name of *hackling*."

The contrariety of influences which are sometimes brought into play by polar and equatorial currents, and those produced by the tides, occasion many phenomena extremely perplexing, and sometimes very dangerous, to the navigator. In the Cattegat, by which the Baltic is connected with the German Ocean, one current always goes in by the side next Jutland, while another issues forth by that nearest to Sweden. In like manner, a current seems to proceed along the eastern coast of Britain towards the south, while another, flowing in an opposite direction, advances along the coast of Holland. What is still more curious, under-currents are sometimes found going in a contrary direction to those upon the surface. At the Straits of Gibraltar, it is said there is always a surface current going in, as if to supply a want in the Mediterranean, while, at a certain depth, there is another going out. So strong and so steady is this contrariety in the Caribbean Sea, that a boat may be moored by dropping a heavy subtance to a certain depth; the upper current impels the boat one way, while the under one draws the sunk object another, and between the two the boat is steadied.

Two currents of equal force, but of different directions, meeting in a narrow passage or gut, will cause a whirlpool, a phenomenon which has ignorantly been said to be produced by subterranean rivers, gulfs,

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chasms, &c., but essentially is only an eddy, produced by the contact of two currents, meeting on a centre. The whirlpool named the Euripides, near the coast of Greece, alternately absorbs and rejects the water seven times in twenty-four hours. Charybdis, in the Straits of Sicily, absorbs and rejects the water thrice in twenty-four hours; and the Maelstrom, on the coast of Norway, which is considerably the largest, absorbs, every six hours, water, ships, whales, in short, every thing that approaches its malignant influence, and the next six hours is employed in casting them up again. These eddies are sometimes augmented by the force of contending tides, or by the action of the winds. They draw vessels along, dash them upon rocks, or engulf them in their furious vortices, the wreck not appearing until some time after.

WATERSPOUTS. — Marine waterspouts are caused by the action of atmospheric currents, and are as dangerous in their effects as they are wonderful in appearance. Malte Brun thus describes them: — "Underneath a dense cloud, the sea becomes agitated with violent commotions; the waves dart rapidly towards the centre of the agitated mass of water, on arriving at which they are dispersed into aqueous vapors, and rise whirling round in a spiral direction towards the cloud. This conical ascending column is met by another descending column, which leans towards the water, and joins with it. In many cases the marine column is from fifty to eighty fathoms in diameter near its base. Both columns, however, diminish towards the middle, where they unite; so that here they are not more than three or four feet in diameter. The en-

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tire column presents itself in the shape of a hollow cylinder, or tube of glass empty within. It glides over the sea without any wind being felt; indeed, several have been seen at once following different directions. When the cloud and the marine base of the waterspout move with unequal velocities, the lower cone is often seen to incline sideways, or even to bend, and finally to burst in pieces. A noise is then heard like the noise of a cataract falling in a deep valley. Lightning frequently issues from the very bosom of the waterspout, particularly when it breaks; but no thunder is ever heard."

Sailors, to prevent the imminent danger which their vessels would be exposed to by coming in contact with these tremendous columns, discharge upon them a cannon-ball, which, passing through them, causes them invariably to burst, and consequently removes all chance of injury connected with them. This phenomenon is accounted for in the following manner: — Two winds meet; a vortex ensues; any cloud which happens to lie between them is condensed into a conical form, and turned round with great velocity; this whirling motion drives from the centre of the cloud all the particles contained in it; a vacuum is thereby produced, and water, or any other body lying beneath this vacuum, is carried into it upon the usual and well known principle. The cannon-ball, breaking this cylinder, which is always partly hollow, causes it to fall to pieces, in the same manner as a touch upon the surface of a soap-ball reduces the resplendent mass to a drop of common water.

TEMPERATURE OF THE SEA. — The temperature of

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the sea, like that of the air, is liable to be affected by the latitude and the season of the year, but not to nearly so great an extent as the air. Within the tropics, where the season has hardly any influence, it is generally found at about 80° or 81° of Fahrenheit's thermometer, being somewhat more, in general, than the warmth of the neighbouring air, which is deprived to a certain extent of its heat, in order to carry on the process of evaporation. Taking the month of March as one of those during which the heat of the sun must be equally determined in both directions by latitude, it appears that in that month the sea has been found, at Lat. 11° 32′ S., of 80.6° Fahrenheit; at Lat. 31° 34′ S., of 75.7°; at Lat. 40° 36′ S., of 59.9°; though in some instances it has been found several degrees more or less at the same season, and under nearly the same latitude. The chief cause of the variation is the perpetual flow of water from the poles to the equator, which has been already explained. It has been pretty nearly ascertained, that, in the tropical seas, it ranges about 9° of Fahrenheit; in the middle of the temperate zone about 12°; and after that decreases with a more rapid and more equable gradation. The temperature of the sea is also affected by its depth. In deep seas, between the tropics, the heat diminishes towards the bottom; while, in more frigid latitudes, it is sometimes observed to become warmer. The sea is a bad conductor of heat; the solar rays can only penetrate about three hundred feet below the surface, nor does the light descend any farther. A small difference is discovered between the observations on temperature in the two hemispheres. For the first 25° towards the

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south, the decrease of heat is slower, and after that more rapid, than towards the north.

It must be evident to every one who considers the great mass of waters composing the ocean, and the interchange of position which must always be taking place, to a greater or less extent, between the upper and warmer parts and the lower and colder, that this comparative equability of temperature is unavoidable, even if there were no other causes to account for it. The uses of that equability are still more obvious, and must add greatly to the wonder we always experience when the economy of nature is minutely traced. By this equability, the natural result of high latitude is more or less corrected, for the advantage of the human beings who happen to be placed there. A milder air breathing from the sea softens the climate all over the adjacent land, and produces a freshness which is of the greatest service to vegetation. On the other hand, in those torrid regions where both animated and vegetable nature is apt to sink beneath the vertical rays of the sun, the cooling breath of the ocean comes, generally at fixed times, reviving the parched soil, and communicating to man sensations of relief and pleasure, which are hardly to be imagined by those who have not experienced them.

Saline Property of the Sea. — The saline property of the sea has never been scientifically accounted for. Some have alleged that it is caused by fossil or rock salt at the bottom, while others maintain that the sea is a homogeneous salt body, that its waters were created, and have continued, and ever will continue, in this saline condition, in the same manner that the atmosphere has been created and exists as a compound body.

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The proportion which the saline matters bear to the water varies considerably. The water of the Atlantic Ocean, within the tropics, contains about one twenty-fourth of its weight of saline matters. There, from the great heat, very great evaporation must go on at the surface; and from the great mass of water, particularly far out at sea, the influence of rivers in counteracting the effect of the evaporation, by adding, fresh water, must be less than usual. In the Frith of Forth, the saline matters form only one thirtieth of the weight of the water. There, less fresh water is removed by evaporation, the climate being much colder; and the fresh water supplied by rivers is greater in proportion, so that the salt matter bears a smaller proportion to the whole. There are chiefly four matters contained in sea-water, — common salt (muriate of soda), glauber salt (sulphate of soda), muriate of magnesia, and muriate of lime. Potash has been detected in sea-water; and it also contains extremely small quantities of two simple substances lately discovered, namely, iodine and bromine, in union with hydrogen. Disregarding all except the four first, the composition of the water of the Atlantic Ocean, as analyzed by Dr. Marcet, may be stated as follows. The quantity examined was 500 grains.

Water	478.420
Muriate of soda . . .	13.3
Sulphate of soda . . .	2.33
Muriate of lime . . .	0.995
Muriate of magnesia . .	4.955
	500 grains.

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Thus it is seen that muriate of soda, or common salt, is the principal solid ingredient in the waters of the ocean, and that muriate of magnesia is the next in importance. Sea-water is to a certain degree more dense, or of greater specific gravity, than pure water. According to Dr. Arnot, "a ship draws less water, or swims lighter, by one thirty-fifth, in the dense, salt water of the sea, than in the fresh water of a river; and for the same reason, a man swimming supports himself more easily in the sea than in a river." Sea-water freezes at 28° of Fahrenheit's thermometer. Fresh water, as is well known, expands equally in its volume, 8° above or below 40°, that is to say, it expands by an increase of temperature up to 48°, or by a diminution of temperature down to 32°, the common freezing point, when it assumes the crystallized or icy form. Thus 40° is the point of mean density, or of smallest volume, in fresh water. By the recent experiments of chemists, it is found that sea-water does not expand by a diminution of temperature down to 32°, because it is reluctant to assume the crystallized form, and when it does freeze at 28°, its ice is very imperfect, being full of pores and interstices, and composed in a great degree of thin spicular flakes, inclosing drops of a strong briny liquid which cannot be crystallized.

Sea-water, on being boiled, or exposed in small quantities to the sun's rays, evaporates, and leaves a residuum of common salt; and the manufacture of this article, by means of pans and furnaces, is carried on upon the shores of almost every civilized country. Innumerable have been the attempts to render sea-

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water useful as an element of food or drink, in cases of great scarcity of fresh water on shipboard, but in no case has a perfectly pure or sweet water been procured. Filtration has no effect, because the saline matters in the water are chemically united with it, and cannot be removed by means merely mechanical. The process of purifying the water to the best advantage consists in distilling it, the vapor being gathered and condensed into a liquid. But this liquid is not entirely fresh or sweet, in consequence of its containing certain gaseous matters; and, therefore, after distillation, the liquid should for a length of time be exposed to the action of the atmosphere, so as to allow the escape as far as possible of the gases with which it is charged. A small quantity of potash or soap put into the water previous to distillation, is said to be useful in purifying it, and rendering it more palatable.

The following plan for procuring fresh water at sea, in a case of emergency, was pursued by a Captain Chapman, when sailing off the north coast of Finland. By accident he lost nearly all his water; and while thus circumstanced, a gale of wind arose, which blew hard for three weeks, and drove him far out to sea. The captain was in great anxiety. The water in the ship would last but a short time, and he had no still on board. But necessity, the mother of invention, aided him in contriving one. By means of an old pitch-pot, with a wooden cover, and a pipe made of a pewter plate, and a cask for a receiver, he commenced operations. He put seven quarts of sea-water and an ounce of soap into the pot, and placed it on the fire. As soon as the pot boiled, the condensed vapor began

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to flow through the pipe into the receiver. In half an hour he obtained a quart of fresh water. This water, though not very palatable, answered for all necessary puposes. They kept their still constantly at work, and got a gallon of water every two hours; and thus the crew were saved from great suffering, if not from actual death.

PHOSPHORESCENCE OF THE SEA. — Every one who has been at sea, and observed the action of the waters at night, must have occasionally, remarked certain luminous appearances in the waves. Accounts of the phosphorescence of the sea may be found in the narrative of almost every voyager. The following description is given by Mr. Stewart, in his "Journal of a Residence in the Sandwich Islands": — "The exhibitions of the day have been followed at night by a phosphoretic scene of unrivalled splendor and sublimity. We had often before observed luminous points, like sparks of fire, floating here and there in the furrow of our vessel, but now the whole ocean was literally bespangled with them. Notwithstanding the smoothness of the surface, there is a considerable swell of the sea; and sparkling as it did on every part as with fire, the mighty heavings of its bosom were indescribably magnificent. It seemed as if the sky had fallen to a level with the ship, and all its stars, in tenfold numbers and brilliancy, were rolling about with the undulations of the billows.

"The horizon in every direction presented a line of uninterrupted light, while the wide space intervening was one extent of apparent fire. The sides of our vessel appeared kindling to a blaze, and, as our bows

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occasionally dashed against a wave, the flash of the concussion gleamed half way up the rigging, and illuminated every object along the whole length of the ship. By throwing any article overboard, a display of light and colors took place surpassing in brilliancy and beauty the finest exhibition of fire-works. A charming effect was produced by a line coiled to some length, and then cast into the water at a distance, and also by a bucket of water dashed from the side of a vessel. The rudder, too, by its motions, created splendid coruscations at the stern, and a flood of light, by which our track was marked far behind us. The smaller fish were distinctly traceable by running lines showing their rapid course, while now and then broad gleamings, extending many yards in every direction, made known the movements of some monster of the deep. But minuteness will only weary, without conveying any adequate impression of the scene; it would have been wise, perhaps, only to have said that it was among the most sublime nature herself ever presents.

"The cause of this phenomenon was long a subject of speculation among men of science, but is now satisfactorily ascertained to be sea-animalculæ of the luminous tribe, particularly the species *Medusa*. The *Medusa pelucens* of Sir Joseph Banks, and the *Medusa scintillans* of Mr. Macartney, emit the most splendid light. The degree and brilliancy of the exhibition are supposed to depend on the state of the atmosphere and sea. A more grand display than that which we have witnessed probably seldom, if ever, takes place."

This phenomenon has been ascribed to various causes, but the explanation presented by Mr Stewart is the

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one now most generally admitted. The little animal by which this light is produced is sometimes called *the glow-worm of the sea.* It is exceedingly small, thin, and transparent, and, like the fire-fly, with which we are all acquainted, emits a brilliant light. The sea contains many animals of this nature, of different species. The *Medusas* have little antennæ or horns, from which they dart a strong light, while the rest of their body remains in obscurity. All the zoöphytes appear to be in a greater or less degree phosphorescent.

Some accurate observers have also thought, that in addition to this *glow-worm* light, there is a luminous appearance originating from the decomposition of vegetable and animal substances, similar to the phosphorescence of rotten wood.

THE COLOR OF THE OCEAN. — The water of the sea is colorless when examined in small quantities, but when viewed in the mass in the wide ocean, it appears to be of an azure or blue tint. The cause of this generally blue color of the deep sea has not been as yet clearly explained; but it seems to be in some degree accounted for by reference to certain principles connected with the science of optics. Probably most are aware that light consists of the set of colors which we see so beautifully displayed in the rainbow. Now, it is a law of light, that, when it enters any body, and is either reflected or transmitted to the eye, a certain portion of it, consisting of more or less of its colors, is lost in the body. The remainder, being reflected, strikes our visual sense, and, whatever color that may be, the object seems of that color. Now, it chances that the portion of light most apt to be reflected from masses

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of transparent fluid is the blue; and hence it is, or supposed to be, that the air and sea both appear of this color.

While there can be no doubt that the ocean is generally of a blue color, it is equally certain that there are many portions of sea in which a different hue appears. The causes of these exceptions from the rule seem to be of various kinds. Frequently, the ordinary color of the sea is affected by the admixture of foreign substances, these being sometimes of a living and organic nature, and sometimes the reverse. The most simple example of the latter class of cases is the common flooding of any stream, when quantities of mud and earthy particles are introduced into the river, and emptied into the sea. What is thus strikingly seen on every coast, on a small scale, will readily be conceived to be of infinitely wider extent in the mighty rivers of the principal continents of the globe.

Thus is it with the great streams of South America, where the Plata forms a sloping bank which extends a hundred miles into the Atlantic, and still more conspicuously in the mighty Amazon, with a course of 3,000 miles and a breadth at the mouth of 150 miles. Its immense body of water often rushes with a dreadful impetus and velocity into the ocean, freshening its waters to the distance of 250 miles from shore. Hence, then, in such circumstances, the mariner, when still far from land, is not surprised when he ploughs an ocean quite of a *brownish hue.*

It is from the same cause that the well known *Yellow Sea* acquires its appearance and appropriate name. Mr. Barrow estimates the quantity of yellow-colored mud

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which is transmitted by the Hoang-ho or Yellow River, whose course is 2,000 miles, at 2,000,000 of solid feet an hour, or 48,000,000 a day, or 17,580,000,000 a year. "Supposing," he adds, "the mean depth of the Yellow Sea to be 120 feet, the quantity of earth brought down would, if accumulated together, be sufficient to fill up to the surface of the sea an island of the extent of a mile square every seventy days." The testimony of Captain Basil Hall is quite satisfactory as to the result of all this. "The water of the Yellow Sea, over which we were sailing, was contaminated by the intermixture of mud slightly yellow in its color. We sailed on directly across this sea for two whole days without seeing land, and gradually diminishing the depth of water, till at last we began to have some apprehension that we should fairly stick in the mud. It was soon afterwards discovered that the brig was actually sailing along with her keel in the mud, which was sufficiently indicated by a long yellow train in our wake. Some inconvenience was caused by this extreme shallowness, but there was not in reality much danger, as it was ascertained, by forcing long poles into the ground, that for many fathoms under the surface on which the sounding-lead rested, the bottom consisted of nothing but mud formed of an impalpable powder, without the least particle of sand or gravel."

Still more striking results arise from living vegetables and animals. The influence of vegetables in coloring large masses of water may be illustrated by a reference to the Lake of Geneva and the Red Sea. The waters of the Lake usually are of a fixed pale blue color, the delicate beauty of which arrests

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the admiration of every traveller. But while such is the proper color of these waters, occasionally, though rarely, they are as decidedly of a green hue; and we have it upon the authority of Sir Humphrey Davy, that on these occasions the change of color is produced by the water being impregnated with vegetable substances. And respecting the Red Sea, let us hear the testimony of the eminent naturalist Ehrenberg. "I was for many months at Tor, on the Red Sea, near Mount Sinai. I there observed the striking phenomenon of the whole bay being of a bloody color; the main sea, beyond the coral reef, was as usual colorless. The short waves of the calm sea carried to the shore a blood-colored shining mass, which it deposited on the sands, so that the whole bay, fully half a league in length, at the ebb of the tide, exhibited a blood-red border more than a foot wide. This appearance was not permanent, but periodical. It attracted my attention as explanatory of the name of the Red Sea, a name hitherto of difficult explanation. Upon examination, this color was found to be produced by one of the algæ, a marine vegetable."

The extraordinary part which animals play in coloring the ocean, may be demonstrated by alluding to the vast tracts of the Northern Sea, which among mariners are familiarly known as *green water*, and which do not, under any circumstances, assume a blue tint. Mr. Scoresby thus describes them:—"After a long run through waters of the common blue color, the sea became green and less transparent. The color was nearly grass-green, with a shade of black. Sometimes the transition between the green and blue water is pro-

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gressive, passing through the intermediate shades in the space of ten or twelve miles; at others, it is so sudden that the line of separation is seen like the ripple of a current, and the two qualities of water keep apparently as distinct as the waters of a large muddy river on first entering the sea. In 1817, I fell in with such narrow stripes of various-colored water, that we passed streams of pale green, olive-green, and transparent blue, in the course of ten minutes sailing." These green regions extend for tens of thousands of miles, and it has been distinctly proved that the peculiar color is produced by inconceivable multitudes of microscopic animals, principally minute sea-blubber, *medusæ*, and *infusoriæ*. Some of these animals are green, and directly produce the color which is exhibited, but many more are yellow, which color, combining with the blue of the sea-water, will also, as every one knows, produce a green tint.

Other appearances, proceeding from a similar cause, and, if possible, still more striking, are also witnessed. Thus, a red color, sometimes characterized as blood or carmine red, frequently astonishes the voyager. The water of the Gulf of California in the Northern Pacific is reddish, whence it is sometimes named the Vermilion Sea. Captain Colnet, in the interesting account of his voyage, states, "That the set of the currents on the coast of Chili may at all times be discovered by noticing the direction of the beds of small blubber with which the coast abounds, and from which the water derives a color like that of blood. I have often been engaged," he adds, "for a whole day in passing through various sets of them."

The celebrated naturalist, D'Orbigny, makes similar

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remarks concerning the waters of the Atlantic. "There are immense tracts," says he, "off the coast of Brazil, filled with small animals so numerous as to impart a red color to the sea; large portions are thus highly colored, and receive from the sailors the name of the Brazil Bank. This bank extends over a great part of the coast of that country, keeping at nearly the same distance from the shore. Another bank of the same sort occurs near Cape Horn, in Lat. 57° S."

Captain Cook, in his third voyage, encountered the same appearances, and states, "That on examination the phenomenon was found to proceed from an infinity of little animals, which, when viewed by the microscope, had the shape of cray-fish of a red color." Hence we are not to wonder, that, according to an intelligent mariner, "The southern seas sometimes presented an appearance which terrified their early navigators, who, seeing large spaces of the sea of a blood-red color, conceived it a portent of some dreadful catastrophe." These singular appearances are not, however, confined to southern regions. At all events, Mr. Scoresby narrates, that he noticed in his last voyage, in 1823, some insulated patches of reddish-brown water, which were found to be occasioned by animalculæ; and often, too, were the icebergs and snows tipped with an orange-yellow stain. "The animal," he adds, "which gives this peculiar color to the sea, is about the size of a pin's head, transparent, and marked with twelve distinct patches of a brownish color." The same appearances have not unfrequently been noticed in fresh water; and, under the name of *blood-rain*, have sometimes caused no small alarm over wide districts.

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We cannot attempt to account for all these appearances, but may remark that M. Ehrenberg, in the steppes of Siberia, examined some of these waters. "In a fen," he remarks, "with a pool of water, the dark red blood-color was very striking, even at a distance. This color I found on examination was confined to the slimy surface, which in different places formed a shining skin. The red color was darkest up the edge of the marsh. M. Chantran, in the year 1797, examined in France a pond which exhibited the same appearances, the water being of a brilliant red color, with a shade between cinnabar and carmine; as did Weber in Germany, near Halle, in 1790. In all these latter instances, the color was produced by infusory animals. Milk-white is another color which is not unfrequently mentioned. Thus Captain Tuckey states, that, near Cape Palmas, upon the coast of Guinea, his vessel appeared to move in milk, which circumstance arose from the multitude of animals upon the surface, which obscured the natural color of the liquid. And, once more, the existence of a yellow-colored sea from the same cause is satisfactorily established. "In approaching the south point of America," says Captain Colnet, "we this forenoon passed several fields of spawn, which caused the water to bear the appearance of barley, covering the surface of a bank."

These causes of varied color in the ocean, however striking in themselves, are not likely to mislead any one as to the inherent color of its waters. It is different, however, with the class of causes to which we now proceed, and which we may arrange under the head of the reflection of colored rays from the bed or bottom of

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the sea. Sometimes, indeed, though rarely, these appearances are quite as singular as any we have hitherto considered. Thus, in the Bay of Loango, the waters are almost always of a deep red color; so much so, that they are said to be mixed with blood, and Captain Tuckey satisfied himself that the bottom is intensely red. Let us substitute for this bright red bottom one of the same shade, but obscure and slightly reflecting, and the water of the Bay of Loango would then appear of an orange-yellow color. Far more frequently, however, the bed of the sea is of a yellow rather than a red hue; and if this color is at all bright and strong, the slight blue of the pure water will scarcely affect it, and then the waters will appear yellow, — a tint which, let it be observed, is in fact by no means uncommon on many sea-shores. But bright yellow is by no means so common a tint of sea-sand as is dull or obscure yellow; and this, owing both to its own proper color, and also to its being obscured by a great mass of superimposed water. When the yellow hue is thus reduced, the feeble ray reflected from the bottom, mixing with the pale blue of the ocean, produces, as is universally known, a green tint, which is communicated to the water; and this is one of the most widely spread modifying causes of change in the proper color of the sea.

But the most difficult part of the problem still remains; and that is, to account for the green color of the ocean in those places where it is hundreds and thousands of fathoms deep, and where, of course, every thing like reflection from the bottom is quite out of the question. M. Arago, to account for the phenomena occuring under such circumstances, offers a theory

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which resolves itself into the principle, that when the surface is troubled, the luminous rays, coming from the waves to the eye, consist more of transmitted rays than of reflected rays, and therefore are green. According to this view, the appearances exhibit themselves only during a breeze which disturbs the surface, and in the midst of a swell, so common over the ocean. The observer stands upon the deck of the vessel, the billows often overtopping the level of the ship; the luminous rays which reach the eye from the sea must have passed from the distant horizon through one or more of the watery ridges; thus the transmitted rays have predominated over the reflected ones, and so, according to the allowed fact, must be green.

Winds. — A change in the temperature, a diminution of the vapor, or any other cause that may occasion a portion of the surrounding atmosphere to contract or expand, will give rise to the aerial currents denominated winds, which, indeed, bear a strong analogy to the currents which occur in the ocean. When the air by which we are surrounded becomes heated, it expands, and becomes specifically lighter, in consequence of which it mounts upward; and the colder and denser air which surrounds the mass thus rarefied rushes in to supply its place. When the door of a heated apartment is thrown open, a current of air is thereby immediately produced; the warm air from the apartment passing out, and the cold air from the passage rushing in. So, also, in those buildings where the manufacture of glass is carried on, the heat of the furnace in the centre being intense, a violent current of air may be observed to force its way

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in through the doors or crevices on the opposite sides of the house.

On applying these principles to account for the origin of the wind, we find, that when the rays from the sun, by their reflection from the earth's surface, have heated or rarefied a portion of the surrounding air, the air so rarefied ascends into the higher regions of the atmosphere, and the colder air by which it was surrounded moves forward in a sensible current to fill the vacuity. When, also, a condensation of vapor in the atmosphere suddenly takes place, giving rise to clouds which speedily dissolve in rain, the temperature of the surrounding air is sensibly altered, and the colder, rushing in upon the warmer, gives rise to a sudden gust of wind. For this reason, a cold, heavy shower passing over head, with a hasty fall of snow or hail, is often attended with a violent and sudden gust of wind, which ceases when the cloud disappears, but is renewed when another cloud, sweeping along in the same direction, brings with it a fresh blast. Accordingly, a whistling, or howling, or noise of the wind, is universally considered to be a prognostic of rain, because it indicates that a change is taking place in the temperature of the atmosphere, owing to the vapor in its higher regions being condensed into rain-clouds.

The most remarkable winds are those which traverse the ocean steadily in one direction, and are called *trade-winds* from their use in mercantile navigation. In order that we may distinctly understand the cause and nature of the trade-winds, it is necessary to bear in mind that the earth in the centre

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of its circumference, at an equal distance from the poles, is divided by a line called the equator into two hemispheres, the Northern and the Southern. By seamen this equator is called *the line;* and when they sail over it, they are said to *cross the line.* Across the equator, cutting it obliquely, there passes another great circle called the ecliptic, which describes the path the sun traverses. It extends 23½° north and 23½° south of the equator, which is the utmost limit the sun traverses; for when arrived at either of these boundaries, he again seems to return towards the equator. It must be very evident that the region of the earth included within a circle drawn 23½° north and 23½° south of the equator, — which will comprehend the greatest portion of Africa, a considerable part of Asia and America, and many large, fertile, and populous islands in the East and West Indies, — will receive constantly the solar rays in a direction so little oblique, that the most intolerable heat might there be anticipated. It was therefore called the torrid zone; and the limits at which the sun stops, and appears to retrace his course, have received the name of tropics, or *circles of return.*

This being premised, and it being also remembered that the earth revolves daily round the sun from west to east, the cause of the trade-winds will be readily understood. The rays of the sun, in its apparent motion from east to west, obviously rarefy, by the heat they impart, the air beneath, and the air so rarefied rises into the higher regions of the atmosphere. While this takes place, the colder air from the adjoining temperate zones rushes in to supply its place. But it is from the

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polar regions, north and south, that these colder currents originally come; and did the earth remain at rest, such would be their obvious direction. Instead of this, however, north of the equator the direction of the trade-winds is from the northeast; south of the equator, from the southeast; the cause of which is thus explained. The velocity with which the earth revolves is inconsiderable, if at all appreciable, at the poles, but increases as we advance, and is at its maximum at the equator; the winds, in sweeping from the poles, do not acquire a corresponding velocity with the motion of the earth as they advance towards the equator; therefore, moving more slowly than the earth, they are left behind, striking bodies with the excess of the earth's velocity; so that, to the observer who imagines himself at rest, the air appears to move in a direction contrary to the rotation of the earth, namely, from east to west. While the trade-wind thus blows upon the surface of the earth, there is no doubt that an opposite current, probably that of the rarefied air which has ascended, flows in the contrary direction at a great elevation in the atmosphere.

The external limits of the trade-winds are 30° north and 30° south of the equator; but each limit diminishes as the sun advances to the opposite tropic. The larger the expanse of ocean over which they sweep, the more steadily do they blow; accordingly, they are more steady in the Pacific than in the Atlantic, and in the South than in the North Atlantic Ocean. Within the region of the constant trade-winds, rain seldom occurs, but it falls abundantly in the adjoining latitudes. The reason is, that rain is produced by the sud-

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den mixture of air of different temperatures charged with moisture; but the constant circulation and intermixture of the air from the upper strata of the atmosphere, or ground current, maintains so equal a temperature in these latitudes as not to occasion the condensation of vapor which is necessary for the production of rain. Besides which, it is plausibly enough alleged by Daniel, that the aqueous vapor constantly flows off in the current of the equatorial wind into the adjoining temperate zones. Within the limits of the trade-winds, contrary to what might have been anticipated from the latitude, the atmosphere is peculiarly cool and refreshing.

Sea and Land Breezes. — In most countries near the shores of the sea, but particularly in tropical climates, there are periodical winds called sea and land breezes; they occur in the following manner. During the day, the wind blows for a certain number of hours from the sea to the land; but when the evening arrives, it changes its direction, and blows as many hours from the land to the sea. In some countries the sea-breeze sets in about seven or eight in the morning, and is strongest at noon, but continues very sensible until three o'clock, when the surface of the sea will be observed to exhibit ripples of a deep blue color. After this, at six in the evening, the land breeze commences. The sea now assumes a greenish hue; and this breeze continues until eight the next morning. The cause of this alternation may be readily explained. During the day, the air over the surface of the earth is more heated by the rays of the sun than that over the surface of the sea; because the earth,

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from its greater density, comparative state of rest, and numerous elevations, reflects the sun's rays sooner, and with more power, than they are reflected from the sea, which, from its state of constant motion and transparency, imbibes the warmth very intimately, though more slowly.

Accordingly, when the sun, having risen above the horizon, has, by the reflection of its rays, thus imparted a sufficient degree of warmth to rarefy the body of air over the land, the air so rarefied ascends into the higher regions of the atmosphere, while that over the surface of the sea, being scarcely at all rarefied, rushes in to supply its place. Hence, a sea-breeze, or current of air from the sea to the land, at this time prevails; but when the sun again begins to sink below the horizon, the body of air over the surface of the land becomes rapidly cold, and the earth itself, by radiation, parts very quickly with the warmth it had absorbed. Then the land air, being below the temperature of the sea air, rushes in to supply its place, and thus during the night, a land-breeze, or a current of air from the land to the sea, is produced. When the sea-breeze first sets in, it commences very near the shore, and gradually extends itself farther out at sea, and, as the day advances, becomes more or less hot. Hence, the sails of ships have been observed quite becalmed six or eight miles out at sea, while at the same time a fresh sea-breeze has been blowing upon the shore.

The cause of this is obvious; for it is natural to suppose that the mass of air nearest the land will be the first to rush in, for the purpose of supplying the place of the air which is rarefied immediately above it.

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On this account, the effect of the sea-breeze is said not to be perceptible at a distance of more than five or six leagues from the shore, and for the most part becomes fainter in proportion to its distance from land. The distance, on the other hand, to which the land-breeze extends in blowing across the sea depends on the more or less exposed aspect of the coast from which it proceeds. In some places this breeze was found by Dampier brisk three or four leagues off shore; in other places not so many miles; in others, again, it scarcely extended without the rocks. The sea-breeze, from blowing over a more open tract, is always stronger than the land-breeze; but it is observed that the land-breeze is much colder than the sea-breeze. Furthermore, it has been noticed that the tendency of the land-breeze at night has almost invariably a correspondence with the sea-breeze of the preceding or following day. "Should the land-wind from being east, draw, in the course of the night, towards the north, it would be looked upon," says Marsden, in his "History of Sumatra," "as an infallible prognostic of a west and northwest wind the next day; and on this principle it is that the natives foretell the direction of the wind, by the noise of the surf at night, which, if heard from the northward, is esteemed the forerunner of a northerly wind, and *vice versâ*.

"The quarter from which the noise is heard depends on the course of the land-wind, which brings the sound with it, and drowns it to leeward; the land-wind has a correspondence with the next day's sea-wind, and thus the divination is accounted for." Unless for the periodical refreshing, cool breezes from the sea,

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the West India Islands, and generally all hot countries, would scarcely be habitable for the white races of men.

HURRICANES. — The most dangerous winds to the navigator are those which occur in sudden gusts, or squalls, and for the approach of which the sharpest outlook is required. When the squall is in the form of a violent tempest, accompanied by rain, lightning, and thunder, it receives the name of a hurricane. Hurricanes occur most frequently and with the greatest violence in tropical climates, because, in consequence of the very great heat which there prevails, the rarefaction of the air, and also the condensation of the vapor it contains into rain-drops, takes place more suddenly and completely than in more temperate regions. By this means the electricity of the atmosphere, — that subtle fluid which seems to pervade all bodies, and which universally seeks its own equilibrium, — is disturbed, and no longer maintains an equal distribution through the aerial vapor. It accumulates in vast quantities in one mass of vapor or cloud, while in another it is deficient; and, consequently, to regain its equilibrium, it flashes in the form of lightning from the surcharged cloud to the cloud that is undercharged, or to the earth itself. Hence, hurricanes are always attended with electrical manifestations, which add greatly to the tragical horrors of the spectacle they exhibit.

In describing the tremendous hurricane which took place in the West Indies in 1772, a writer observes; — "I must still mention how dreadful every thing looked in this horrible and dark night, there being so many fiery meteors in the air, which I and others who were in the same situation were spectators of. Towards

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the east, the face of the heavens presented to our view a number of fiery rods, — electrical brushes, — which were through the whole night shooting and darting in all directions; likewise fiery balls, which flew up and down, here and there, and burst into a number of small pieces, which, like torches of flaming straw, came very near the road where we lay; yet, notwithstanding all these phenomena, thunder and lightning were abundantly great."

Hurricanes commence in various ways: sometimes from a single and small cloud, which suddenly expands, overspreading, as with a dense shroud, the whole heavens; and sometimes from a slowly gathering mass of clouds which appear to be irradiated with electric fire. When the enterprising navigator, Columbus, was about to depart from Isabella Island, while his vessels were still in the harbour, one of these dreadful hurricanes arose. "About mid-day," says Washington Irving, "a furious wind sprang up from the east, driving before it dense volumes of cloud and vapor. Encountering another tempest from the west, it appeared as if a violent conflict ensued. The clouds were rent by incessant flashes, or rather streams, of lightning. At one time they were piled up high in the sky, at another they descended to the earth, filling the air with a baleful darkness more impenetrable than the obscurity of midnight. Wherever the hurricane passed, whole tracts of forests were shivered and stripped of their leaves and branches, and those of gigantic size, which resisted the blast, were torn up by the roots, and hurled to a great distance. Groves were torn from the mountain precipices, and vast

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masses of earth and rock precipitated into the valleys with terrific noise, choking the course of the rivers. The fearful sounds in the air and on the earth, — the pealing thunder, — the vivid lightning, — the howling of the wind, — the crash of falling trees and rocks, — filled every one with affright, and many thought that the end of the world was at hand. Some fled to caverns for safety, for their frail houses were blown down, and the air was filled with the trunks and branches of trees, and even with fragments of rocks, carried along by the fury of the tempest. When the hurricane reached the harbour, it whirled the ships round as they lay at anchor, snapped their cables, and sunk three of them to the bottom, with all who were on board. Others were driven about, dashed against each other, and tossed, mere wrecks, upon the shore by the swelling surges of the sea, which in some places rolled for three or four miles upon the land. The tempest lasted for three hours. When it had passed away, and the sun again appeared, the Indians regarded each other with mute dismay. Never, in their memory, nor in their traditions, had their island been visited by such a tremendous storm. They believed that the Deity had sent this fearful ruin to punish the cruelties and crimes of the white men, and declared that this people had moved the very air, the water, and the earth, to disturb their tranquil life, and to desolate their island."

The West Indies, the Isle of France, and the empires of Siam and China, are the countries which are most subjected to the ravages of hurricanes. In the West Indies they most frequently occur in the month of August, and the Indians, from their experience, origi-

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nally taught our planters the signs by which their approach may be prognosticated. The hurricane occurs either in the first quarter or at the full change of the moon. If it come on at the full, then at the preceding change the sky looks troubled, and the sun more red than usual; besides which, there is a dead calm below, and the mountain tops are free from those mists which usually overhang them. In the caverns of the earth, and in wells, a hollow, rumbling noise, like a rushing wind, is heard, and animals are observed to tremble and be much disturbed. Many animals, indeed, appear to be very sensible of any change in the electrical state of the atmosphere, and indicate their uneasiness by moaning and great restlessness. At night the stars seem larger than usual, and are frequently surrounded with halos. It is said, also, that the sea emits a strong smell, and rises into vast waves, without any wind being perceived. When the wind rises, it shifts from its common easterly direction to the west, whence, with occasional intermissions, it blows irregularly and violently. The moon, likewise, is frequently surrounded by a halo, and many luminous meteors appear in the heavens. Notwithstanding that by observation we may thus predicate the approach of hurricanes, it does not appear that we are at present able to avert them by any contrivance of art. The careful and skilful mariner, as his only safeguard, trusts to the trimming of his vessel to meet the expected tempest.

Calms and Breezes. — "After a storm comes a calm," is an old proverb. The fury of the tempest expends itself, and in all likelihood there shortly after ensues a state of tranquillity, though several days may

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elapse before the "swell," or heaving agitation of the sea, subsides. When both the atmosphere and the waters are tranquil, the surface of the ocean is beautifully calm, and almost as smooth as the glassy surface of a lake. But a perfect or dead calm, if of any continuance, is almost as disagreeable to the navigator as a driving tempest. The ship makes no progress in its course; its sails are useless; and there are no means of removing from the dull and distressing scene. This condition of things is well described by the poet.

"Down dropped the breeze, the sails dropped down,
'T was sad as sad could be,
And we did speak only to break
The silence of the sea!

"All in a hot and copper sky,
The bloody sun at noon,
Right up above the mast did stand
No bigger than the moon.

"Day after day, day after day,
We stuck, nor breath nor motion;
As idle as a painted ship
Upon a painted ocean.

"Water, water everywhere,
And all the boards did shrink;
Water, water everywhere,
But not a drop to drink."

Fortunately, dead calms are not generally of that continuance which leads to any serious result. A gentle breeze begins to steal upon the face of the deep, and the hitherto unruffled surface of the waters shows a slight, tremulous ruffling, technically called the *crow's foot*. Sailors have a superstitious belief, that whistling

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in a calm will bring up a breeze, and this they do with a drawling and beseeching intonation on some prominent part of the vessel. Captain Hall gives a description of the rise of a breeze, in connection with these whistling efforts of the sailors, on board a ship.

"In the course of the afternoon, we perceived from the mast-head, far astern, a dark line along the horizon, which some of our most experienced hands pronounced the first trace of a breeze coming up. In the course of half an hour, this line had widened so much that it could easily be perceived from the deck. Upon seeing this, the whistlers redoubled their efforts; and whether, as they pretended, it was owing to their interest with the clerk of the weather-office, or whether the wind, if left alone, would have come just as soon, I do not venture to pronounce; but certain it is, that, long before sunset, our hearts were rejoiced by the sight of those numerous flying patches of wind, scattered over the calm surface of the sea, and called by seamen *cat's-paws*, — I presume from the stealthy, timorous manner in which they seem to touch the water, and straightway vanish again. By and by, the true wind, the ripple from which had marked the horizon astern of us, and broken the face of the mirror shining brightly everywhere else, indicated its approach, by fanning out the sky-sails and other flying kites, generally supposed to be superfluous, but which upon such occasions as this do good service, by catching the first breath of air, that seems always to float above the water. One by one the sails were filled; and, as the ship gathered way, every person marked the glistening eye of the helmsman, when he felt the spokes of the wheel pressing against

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his hand, by the action of the water upon the rudder."

THE POLAR SEAS. — The seas within the Arctic and Antarctic circles exhibit appearances so very remarkable, in consequence of the intense cold which there prevails, that they deserve a particular description. The following vivid sketch of scenes observed within the Arctic seas will be read with interest: —

"After the continued action of the sun has at last melted away the great body of ice, a short and dubious interval of warmth occurs. In the space of a few weeks, only visited by slanting and enfeebled rays, frost again resumes his tremendous sway. It begins to snow in August, and the snow falls to the depth of two or three feet before October. Along the shores and bays, the fresh water, poured from rivulets or drained from the thawing of former collections of snow, becomes quickly converted into solid ice. As the cold augments, the air deposits its moisture, in the form of a fog, which freezes into a fine, gossamer netting, or slender icicles, dispersed through the atmosphere, and so extremely minute, that they seem to pierce and excoriate the skin. The hoar-frost settles profusely, in fantastic clusters, on every prominence. The whole surface of the sea steams like a lime-kiln, — an appearance called the *frost-smoke*, caused, as in other instances of the production of vapors, by the waters being still relatively warmer than the incumbent air.

At length the dispersion of the mist, and the consequent clearness of the atmosphere, announce that the upper stratum of the sea itself has become cooled to the same standard; a sheet of ice spreads quickly over

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the smooth expanse, and often gains the thickness of an inch in a single night. The darkness of a prolonged winter now broods inpenetrably over the frozen continent, unless the moon chance at times to obtrude her faint rays, which only discover the horrors and wide desolation of the scene." The wretched settlers, covered with a load of bear-skins, remain crowded and immured in their huts, every chink of which they carefully stop against the piercing external cold, and, cowering about the stove or the lamp, they seek to doze away the tedious night. Their slender stock of provisions, though kept in the same apartment, is often frozen so hard as to require to be cut with a hatchet. The whole of the inside of their hut becomes lined with a thick crust of ice; and if they happen for an instant to open a window, the moisture of the confined air is immediately precipitated in the form of a shower of snow. As the frost continues to penetrate deeper, the rocks are heard at a distance to split with loud explosions. The sleep of death seems to wrap up the scene in utter and oblivious ruin.

At length the sun reappears above the horizon; but his languid beams rather betray the wide waste than brighten the prospect. By degrees, however, the further progress of the frost is checked. In the month of May, the famished inmates venture to leave their huts, in quest of fish on the margin of the sea. As the sun acquires elevation, his power is greatly increased. The snow gradually wastes away, the ice dissolves apace, and vast fragments of it detached from the cliffs and undermined beneath, precipitate themselves on the shores with the noise and crash of thunder. The ocean

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is now unbound, and its icy dome broken up with tremendous rupture. The enormous fields of ice thus set afloat are, by the violence of winds and currents, again dissevered and dispersed. Sometimes impelled in opposite directions, they approach, and strike with a mutual shock, like the crash of worlds, — sufficient, if opposed, to reduce to atoms, in a moment, the proudest monuments of human power. It is impossible to picture a situation more awful than that of the poor crew of a whaler, who see their frail bark thus fatally inclosed, expecting immediate and total destruction. Before the end of June, the shoals of ice in the Arctic seas are commonly divided, scattered, and dissipated. But the atmosphere is then almost continually damp, and loaded with vapor. At this season of the year, a dense fog generally covers the surface of the sea, of a milder temperature, indeed, than the frost-smoke, yet produced by the inversion of the same cause. The lower stratum of air, as it successively touches the colder body of water, becomes chilled, and thence disposed to deposit its moisture. Such thick fogs, with mere gleams of clear weather, infesting the northern seas during the greater part of the summer, render their navigation extremely dangerous. In the course of the month of July, the superficial water is at last brought to an equilibrium of temperature with the air, and the sun now shines out with a bright and dazzling radiance.

There is no region of our globe more full of appalling scenes and exciting dangers. The descriptions given by those who have ventured among the bleak tempests of these northern seas almost cause the blood to chill in our veins. Many a ship has been surrounded by

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vast islands of ice, and the wretched seamen have there found their graves. Who can read without agitation the following graphic sketch: —

"The fields of ice are frequently of immense extent. Cook found a chain of them which joined Eastern Asia to North America. The appearance of these continents and islands of ice surpasses all that imagination can conceive. Here we fancy that we behold mountains of pure crystal, and valleys sown with diamonds. There grayish towers, with their resplendent points, seem to rise above a rampart crowned with ice. The magnifying medium of a hazy atmosphere renders this spectacle still more gigantic. He must have a heart of iron who dare penetrate into these inhospitable seas; for if the navigator has not to fear tempests, which are extremely rare in these latitudes, nor waterspouts and hurricanes, which are there unknown, he will be assailed by other dangers much more capable of appalling the most intrepid minds. Sometimes huge bodies of ice, impelled along by the winds and the currents of the sea, dash against the frail vessel; and there is no rock so dangerous or so difficult to avoid. Sometimes these floating mountains treacherously surround the navigator, and block up every outlet; his ship is arrested in her course, and becomes immovable. In vain does the feeble axe endeavour to break these enormous masses, in vain do the sails invite the winds; the ship, as it were soldered into the ice, and the mariner, cut off from the world of living beings, remain fixed in a solitude of death. How frightful is the situation of those who, thus hemmed in by the ice, have no other resource left than to quit their vessel and walk

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over that consolidated crust of sea, which is every moment cracking and ready to sink under their feet! When almost dead with cold and hunger, they consider themselves fortunate should the floating piece of ice on which they sail cast them upon the shore of Siberia or Nova Zembla. But there is generally very little hope of life for the wretched beings who suffer shipwreck in these dreadful regions. Either the icy waves engulf them, or they are devoured by the tyrant of this dreadful empire, the white bear; or, lastly, the intensity of the cold extinguishes the vital heat, their feet adhere to the ice, their blood no longer circulates in their veins, and the polar night becomes to them a night which is eternal."

A terrific account has been given of a ship once found floating in this ocean surrounded with fields and mountains of ice, and every individual of the ship's company frozen. The intensity of the cold had preserved every body from corruption. It seems that the ship had been caught in the ice, and detained in defiance of every effort to liberate her. All their fuel was soon consumed. Their fire expired. Every soul was stiffened in death. One gentleman was found with his pen in his hand writing to his absent wife.

The origin of the immense ice mountains which northern navigators so frequently meet, is difficult to be ascertained. The ice which obstructs the navigation of the Arctic seas is of two different kinds. One kind is formed by the congelation of salt water. It is fibrous and very porous, and not at all transparent. Sometimes, as far as the eye can reach, a compact, unbroken field extends. Again, the whole ocean seems filled

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with floating fragments, closely jammed together. Again, those fragments are so separated that a ship may work its way along between them. And still again, these fragments, dashed together by the winds, are ground up to minuter fragments, called *mash ice.*

But the ice mountains, or *icebergs*, as they are usually called, are evidently of different origin; they are formed by the congelation of fresh water, and not salt.

From them, ships supply their casks with the purest and softest water. These mountains rise to an immense height, sometimes towering far above the masts of the largest ships. No explanation of the origin of these has appeared more satisfactory than the one we now quote from a writer in the Edinburgh Review.

"In those inhospitable tracts, the snow which annually falls upon the islands or continents, being again dissolved by the progress of the summer's heat, pours forth numerous rills and limpid streams, which collect along the indented shores, and in the deep bays inclosed by precipitous rocks. There this clear and gelid water soon freezes, and every successive year supplies an additional investing crust, till, after the lapse, perhaps, of several centuries, the icy mass rises at last to the size and aspect of a mountain, commensurate with the elevation of the adjoining cliffs. The melting of the snow, which is afterwards deposited on such enormous blocks, likewise contributes to their growth; and, by filling up accidental holes or crevices, it renders the whole structure compact and uniform. Meanwhile, the principle of destruction has already begun its operations. The ceaseless agitation of the sea gradually wears and undermines the base of the icy mountain, till at length,

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by the action of its own accumulated weight, when it has perhaps attained the altitude of one or two thousand feet, it is torn from its frozen chains, and precipitated with a tremendous plunge into the abyss below. The mighty launch now floats like a lofty island on the ocean; till, driven southwards by the winds and currents, it insensibly wastes and dissolves away in the wide Atlantic.

"Such we conceive to be the real origin of the icy mountains or *icebergs*, entirely similar in their formation to the *glaciers* which occur on the flanks of the Alps and Pyrenees. They consist of a clear, compact, and solid ice, which has the fine green tint verging to blue, which ice or water, when very pure, and of sufficient depth, always assumes. From the cavities of these icebergs, the crews of the northern whalers are accustomed, by means of a *hose* or flexible tube of canvass, to fill their casks easily with the purest and softest water. Of the same species of ice, the fragments which are picked up as they float on the surface of the ocean yield the adventurous navigator the most refreshing beverage."

The quantity of ice occasionally met, even by navigators in the middle of the temperate zone, is truly amazing. Not unfrequently do the regular packets from Liverpool to the United States fall in with these huge floating islands, and vessels in the night have been dashed to pieces by driving against them. Harbours in the northern parts of America are frequently filled with ice driven from the Northern Ocean, and forced in by the wind. The storms of the Arctic Sea pile cake upon cake, forcing the ice at times to rise to an enor-

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mous height, and decking the bleak scene with most fantastic forms of beauty, and terrific spectacles of grandeur.

The mountains of hard and perfect ice, it has been shown, are the gradual production of perhaps many centuries. Along the western coast of Greenland, prolonged into Davis's Straits, they form an immense rampart, which presents to the mariner a sublime spectacle, resembling at a distance whole groups of churches, beetling castles, or fleets under full sail. Every year, but especially in hot seasons, they are partially detached from their seats, and whelmed into the deep sea. In Davis's Straits, these icebergs appear most frequent; and about Disco Bay, where the sounding exceeds three hundred fathoms, masses of such enormous dimensions are met with, that the Dutch seamen compare them to cities, and often bestow on them the familiar names of Amsterdam or Haarlem. They are carried towards the Atlantic by the current, which generally flows from the northeast; and after they reach the warmer water of the lower latitudes, they rapidly dissolve, and finally disappear, probably in the space of a few months.

Waves. — The waves of the ocean are various in figure and dimensions, according to the force and direction of the winds, contending currents, and other causes. The common cause of waves is the friction of the wind upon the surface of the water. Little ridges or elevations first appear, which, by continuance of the force, gradually increase, until they become the rolling mountains seen where the winds sweep over a great extent of water. In rounding the Cape

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of Good Hope, waves are met with, or rather swells, so vast, that a few ridges and a few depressions occupy the extent of a mile.

The velocity of waves has relation to their magnitude. The large waves just spoken of proceed at the rate of from thirty to forty miles an hour. It is a vulgar belief that the water itself advances with the speed of the wave, but in fact the *form* only advances, while the *substance*, except a little spray above, remains rising and falling in the same place, with the regularity of a pendulum. A wave of water, in this respect, is exactly imitated by the wave running along a stretched rope when one end is shaken; or by the mimic waves of our theatres, which are generally undulations of long pieces of carpet, moved by attendants. But when a wave reaches a shallow bank or beach, the water becomes really progressive, for then, as it cannot sink directly downwards, it falls over and forwards, seeking the level.

So awful is the spectacle of a storm at sea, that it is generally viewed through a medium which biases the judgment; and, lofty as waves really are, imagination pictures them loftier still. A wave rarely rises more than ten feet above the ordinary sea-level, which, with the ten feet that its surface afterwards descends below this, gives twenty feet for the whole height, from the bottom of any water-valley to an adjoining summit.

MARITIME DISCOVERY. — Navigation is the art of conducting vessels at sea in the direction in which they are designed to proceed; the term is derived from the Latin words *navis*, a ship, and *ago*, to manage or govern. From *navis* also is derived the term *navy*,

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which signifies a collection of ships. The terms *marine*, *maritime*, and *mariner*, are likewise from a Latin root, to wit, *mare*, the sea.

Of the early history of ship architecture and navigation, little can be said of any importance. The buoyant property of water, particularly that of the sea, must have been soon observed by mankind, and therefore, beginning with rude skiffs and canoes, they would in time acquire sufficient experience and skill to construct vessels of a larger size, and to guide them in the required direction by means of a rudder and sails. The cultivated nations of antiquity, Egyptians, Carthaginians, Phœnicians, and others, living on the shores of the Mediterranean, possessed ships both for commerce and war, some of which were of a large size, and moved by rowers, and winds acting on the sails. But no people of antiquity possessed the courage or skill to navigate their vessels out of sight of land, or, at least, to push into the open Atlantic or other great oceans.

Maritime intercourse, for the sake of traffic, was carried on only along the shores of the Mediterranean, or down the Red Sea, and along the coast to India, or along the western shore of Europe to Britain. The Romans thought they performed a wonderfully bold feat when they sailed a ship as far as the northern islands of Scotland. In these times there was no other known guide, with respect to the cardinal points, than the stars by night and the sun by day; and, therefore, when clouds covered the visible horizon, or when total darkness ensued at night, the ship was necessarily brought to a pause, or placed in the most imminent

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danger of being wrecked on some unknown shore. This, however, was not the only difficulty. The nations of antiquity, with all their learning, were utterly ignorant of the form and size of the globe. They believed that the world was a great flat plain, with the habitable earth placed in the midst of the ocean; that this ocean was of interminable breadth; and that, at a certain distance from land, the waters were shrouded in eternal darkness. With such notions prevailing among mankind for thousands of years, it is not surprising that they should have made so slow advances in the art of navigation, or done so little for maritime discovery.

During the Middle Ages, from the fourth to the fourteenth century, ship-building was considerably improved by the Italians, who then conducted a large maritime traffic on the Mediterranean; but the art of navigation, in the proper sense of the term, was still in its infancy, and its history cannot be said to commence till the beginning of the fourteenth century, when that wonderful instrument, the mariner's compass, was discovered, or came first into observation in Europe. Of the polarity of the magnet, or its tendency to point to the poles, it is here only necessary to say how this polarity is rendered subservient to the purposes of the navigator. The mariner's compass, which consists of a magnetized slip of metal, or needle, as it is called, poised on its centre, and free to point to the poles, was first made known, as far as it can be ascertained, by one Flavio Gioja, an Italian, in the year 1302. As with all great discoveries, its advantages were not at once recognized. It had to contend

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against a variety of prejudices; but these in time vanished, and about the middle of the fourteenth century its important uses were allowed and established.

Navigation now assumed a much bolder character than formerly. The English, Portuguese, Italians, and Spaniards pushed their vessels into districts of ocean never previously traversed, and thus the way was fairly opened for maritime discovery. The first great discoverer who made use of the compass, and partly improved its construction, was Prince Henry, a son of the king of Portugal, and who is known in history by the name of Henry the Navigator. This intelligent and enterprising prince (born 1394, died 1361), with the concurrence of the Portuguese government, set on foot a series of maritime enterprises, with the view of discovering a route to India by way of the Atlantic. These voyages ultimately proved successful; the islands of Puerto Santo, Madeira, and the Canaries, were successively discovered, and annexed to the crown of Portugal.

In 1433, the Portuguese navigators penetrated beyond Cape Bojador, on the coast of Africa, which was considered an extraordinary performance; another expedition afterwards went as far as Cape Blanco, and discovered the island of Arguin and the Cape de Verde Isles; and, in 1448, the Azores were reached and made known. Henry the Navigator thus struck a spark which kindled to a flame all over Europe. Not long after his death, the Guinea coast was added to the Portuguese discoveries. In 1484, the Congo was reached by Diego Cam; in 1487, the Cape of Good Hope was doubled by Bartholomew Diaz; and, in 1498, Vasco de Gama touched the shores of Hindostan.

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The Portuguese having received an assignment from the Pope of all lands that could be discovered on the African coasts, the Spanish government, burning with anxiety to emulate the late proceedings of its neighbours, was compelled to seek out new countries in a different direction. Ferdinand and Isabella, the sovereigns of Spain, listened, therefore, to the speculations of Columbus regarding a route to India across the Atlantic, and sent him off on a mission. In his bold attempt to reach Hindostan by pursuing a direction across the Atlantic, he landed on one of the American islands, now called the Bahamas, on the 12th of October, 1492. About the year 1499, Amerigo Vespuceii, under an appointment from the Spanish government, discovered the coast of the South American continent, and hence the name of *America* was given to the New World, although, as is well known, Columbus had previously discovered and landed on South America, without being aware that it was the continent which he had reached.

Several subsequent voyages by Spanish navigators disclosed the extent of the east coast of South America, and, in 1513, Nunez de Balboa crossed the isthmus of Panama with an exploring party of his sailors, and made the discovery of the Pacific Ocean on the west coast of that continent. It was now seen that America was not, as had been at first believed, a portion of Asia or India, but was a separate territory of vast extent lying between the Atlantic and Pacific. There was yet a doubt with respect to the southern extremity of America; but in 1520, Magellan made the passage from the Atlantic to the Pacific by the straits which

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separate America from the island of Terra del Fuego, at about the fifty-third degree of south latitude, and so removed all doubt upon the subject. This navigator extended his voyage across the Pacific to the Philippine Islands, where, unfortunately, he was killed; but his companions proceeded in the route homewards by the Cape of Good Hope, and thus, by circumnavigating the globe, settled the long-disputed problem with respect to the sphericity of our planet. This most important voyage was made between the years 1520 and 1523.

In the mean while, several maritime discoveries were made by the English nation. In 1495, John Cabot, a Venetian pilot, settled at Bristol, obtained from Henry the Seventh letters patent, empowering him and his three sons, Lewis, Sebastian, and Sanctius, to discover unknown lands, and conquer and settle them. In consequence of this permission, the king supplied one ship, and the merchants of London and Bristol a few smaller ones, and in 1496 John and Sebastian sailed to the northwest. In July of the same year, they discovered Newfoundland, and explored it up to Lat. 67° N. In a subsequent voyage, the father and son sailed as far as Cape Florida, and are believed to have been the first who saw the main land of America. By these and succeeding voyages of discovery in the reigns of Henry the Eighth, Edward the Sixth, and Elizabeth, the English became possesssed of the eastern coast of North America, and some of its islands. Between the years 1740 and 1744, Anson was employed in circumnavigating the globe, and visiting different parts of the Pacific; but this extensive and

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protracted voyage added little to the existing knowledge of geography. At a later period, in the reign of George the Third, Cook explored the groups of islands in the Pacific, making various interesting discoveries, in which was included a survey of the eastern coasts of Australia and Van Diemen's Land, and a visit to the New Zealand Islands. After the voyages of this enterprising navigator, little was left to perform in the way of maritime discovery, except in exploring the northern extremities of the American continent. A series of voyages for this purpose was begun in 1818, conducted by Ross, Parry, and others, and which lately terminated by establishing the fact, that a passage for ships exists between the Atlantic and Pacific, round the northern promontories of America, but that, from the blocking of ice, such a passage can only be open to navigators on rare occasions, and is therefore of no practical value.

Utility of the Ocean. — The utility of the ocean in equalizing the temperature of the globe, in furnishing a highway for the intercourse of nations, in supplying an unfailing fountain of salt for the use of man, in providing an exhaustless storehouse of food, — has attracted the attention of every reflecting mind. There is another source of interest in this grand feature of nature, which is less obvious, but still hardly less important, — we mean, its moral and poetical associations. The influence of these upon the mind is beautifully set forth in the following passages.*

"The ocean is wonderful and divine in its forms

*From "Religion of the Sea," by F. W. P. Greenwood.

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and changes and sounds, in its grandeur, its beauty, its variety, its inhabitants, its uses and its mysteries, in all that strikes the sense and is immediately apprehended by the understanding. But besides all these, and lying deeper than all, it possesses a moral interest, which is partly bestowed upon it, and partly borrowed from it, by the mind of man. The soul finds in it a fund of high spiritual associations. Analogies are perceived in it, which connect it most affectingly with our mortal life, with dread eternity, and with Almighty God himself, the source and end of all. And thus it becomes a principal link in that great chain of purpose and sympathy, with which the Creator has bound up all matter and mind, together with his own infinite being, in one consenting whole.

"The sea has often been likened to this our life. Poetry is fond of remarking resemblances between it and the passions and fortunes of humanity. Our contemplations launch forth on its capacious bosom, and gather up the images and shadowings of our existence and fate, of what we are, and what is appointed to us. Do we see its multitudinous waves rushing blindly and impetuously along wherever they are driven by the lashing wind? They remind us of the tempest of an angry mind, or the tumult of an enraged people. Are the waves hushed, and is a calm breathed over the floods? It is the similitude of a peaceful breast, of a composed and placid spirit, or a quiet, untroubled time. Doubts, anxieties, and fears pass over our minds, as clouds do over the sea, tinging them, as the clouds tinge the waters, with their deep and threatening hues. Does a beaming hope or a golden joy break in suddenly

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upon us, in the midst of care or misfortune? What is it but a ray of light, such as we sometimes behold sent down from the rifted sky, shining alone in the dark horizon, a sun-burst on a sullen sea?

. . . . . .

"Thus discourses the ocean on the great themes of mortality, — the eloquent ocean, sounding forth incessantly, in its deep-toned surges, a true and dignified philosophy; repeating to every shore the moral and the mystery of human life.

"But it does something more. It is so vast, so uniform, so full, so all-enveloping, that it leads the thoughts to a sublimer theme than life or time, to the theme of dread eternity. When contemplations on this subject are suggested by it, human life shrinks up into a stream, wandering through a varied land, now through flowers, and now through sands, now clearly and now turbidly, now smoothly and quietly, and now obstructed and chafed, till it is lost at last in the mighty ocean, which receives, and feels it not. There is nothing among the earthly works of God, which brings the feeling, — for it can hardly be termed a conception, — the feeling of eternity so powerfully to the soul, as does the 'wide, wide sea.' We look upon its waves, succeeding each other continually, one rising up as another vanishes, and we think of the generations of men, which lift up their heads for a while and then pass away, one after the other, for all the noise and show they make, even as those restless and momentary waves. Thus the waves and the ages come and go, appear and disappear, and the ocean and eternity remain the same, undecaying and unaffected, abid-

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ing in the unchanging integrity of their solemn existence.

. . . . .

"Where are the myriads of men who have trodden its shores, and gone down to it in ships? They are passed away. Not a single trace has been left by all their armaments. Where are the old kingdoms which were once washed by its waves? They have been changed, and changed again, till a few ruins only tell where they stood. But the sea is all the same. Man can place no monuments upon it, with all his ambition and pride. It suffers not even a ruin to speak of his triumphs or his existence. It remains as young, as strong, as free, as when it first listened to the Almighty Word, and responded with all its billows to the song of the morning stars.

"'Time writes no wrinkle on thine azure brow;
Such as creation's dawn beheld, thou rollest now.'

"It is this immutability, which, more than any other of the attributes of ocean, perhaps, impresses our minds with the sentiment of eternity, and gives to it its character of superiority among the works of God. Earth never frees itself entirely from the subjection of man. It constantly receives and covers his fallen remains, indeed, but is made to bear memorials of the victor, even after he is vanquished. All over the world we see the vestiges of former generations; their caves, their wells, their pyramids, their roads, their towers, their graves. But none of these things are on the sea. Its surface is unmarked but by its own commotions; and when it buries man or man's works, the sepulture is sudden and entire; a plunge, a bubble, and the waters roll on

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as before, careless of the momentary interruption of their wonted flowing. Thus immutable, thus unworn and unsullied is ocean. To what shall it be compared, but to the highest subjects of thought, to life and to immortality? It allies itself in its greatness more with spirit than with matter. It holds itself above subjection or control. It seems to have a will, a liberty, and a power.

"As these are high associations, they readily lead us up to Him who is above all height. There is a natural connection between all sublime and pure sentiment and the conception of Deity. All grandeur directs us to him, because we have learnt that he is greatest. We cannot stop in the creature after we have received any true ideas of the Creator. And thus God himself comes, as if by an influence of his spirit, into our minds, when we are looking upon the sea, or listening to its roar, and imbibing the emotions which it is so powerful to excite. Where he comes, he reigns. The conception of God, when it enters, takes the throne of authority among the other thoughts, and brings them into easy subordination. And then we think how inferior and dependent are all might and majesty, compared with his. The eternity of ocean becomes a brief type of the eternity of him who made it, and all its grandeur as a passing shadow of his. It does not, however, lose any of its interest, by this kind of inferiority. Nothing is lessened to the pious mind by being esteemed less than the Supreme. It retains its connection with eternity and God, and is exalted by its glorious dependence. It puts on the aspect, and speaks with the added solemnity of religion; telling us that

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all its power and magnificence are from the Maker, and that if it is full of beauty, and life, and usefulness, and mystery, it is because the Maker is good, and wise, and infinite.

"The sea has been called the religious sea. It is religious, as it suggests religious thoughts and emotions. And as the feelings excited by a noble object in a contemplative soul are always in some degree reflected back upon that object, the sea will appear to be in its own self religious; to know that it is lying in the hollow of the Almighty's hand; to chant loud anthems to his praise in the noise of its rushing floods, and to send up its more quiet devotions in the breathing stillness of its calms. In short, we know nothing of the sea as we ought to know, we feel nothing of its best and sublimest inspirations, unless we receive from it, and communicate to it, the thoughts and feelings of religion; unless we grow devout as we gaze, and return from contemplating it with the consciousness that we have entered into a nearer union with God."

CLIMATOLOGY.

THE climate of a country comprises whatever relates to the degree of heat and cold to which it is subject, the dryness and moisture of the air, its healthfulness or insalubrity. The causes which affect and determine the climate of a place are nine; 1. the action of the sun upon the atmosphere; 2. the internal heat of the globe; 3. the height of the place above the

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level of the sea; 4. the general exposure of the region; 5. the position of its mountains relatively to the cardinal points; 6. the neighbourhood of the sea and its relative position; 7. the geological character of the soil; 8. the degree of cultivation which it has received, and the density of the population collected upon it; and 9. the prevalent winds. These causes, acting together or separately, determine the character of a climate as moist and warm, dry and warm, mild and moist, mild and dry, cold and moist, cold and dry, &c.

The torrid zone has but two seasons; the wet and the dry. The latter is considered as the summer, and the former as the winter of the regions within this zone, but they are in direct opposition to the astronomical seasons, as the rains follow the sun. In some districts there are two rainy and two dry seasons every year. The temperature is uniform to the distance of ten or fifteen degrees from the equator, but in the neighbourhood of the tropics there is a great difference between the temperature when the sun is in the zenith, and when he is in the opposite solstice of any place. The climate of the equatorial zone is more temperate than that of the tropical regions, in which extreme heats prevail during the presence of the sun.

In the temperate zones only is the year divided into the four seasons, exhibiting the grateful vicissitude of heat and cold, the varied charms of spring and autumn, the tempered fires of summer, and the healthful rigors of winter. This regular succession of the annual changes can, however, hardly be considered to extend further than from 35° to 60° of latitude.

In the frigid zones two seasons only are known; a

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long and severe winter is abruptly followed by the insupportable heats of a short but burning summer; this harsh transition and strong contrast is occasioned by the great length of the summer days, and the total absence of the sun in winter.

There is a remarkable difference in climate between the eastern and western shores of the two continents, the latter being considerably milder. Thus along the shores of Europe the climate is from eight to ten degrees warmer, especially in winter, than on the opposite American coast in the same latitudes. Paris, which is about eight degrees north of New York, has a milder winter climate than the latter city. The western coast of the American continent, toward the north, has also a milder climate than the opposite shores of Asia, in the same parallels.

The extremes of temperature are experienced chiefly in large inland tracts, and are little felt in small islands remote from continents. In the United States, intense cold is felt when the wind blows from the frozen regions round Hudson's Bay. From snow-clad mountains, gusts of cold wind, called *snow winds*, rush down and cool the adjacent plains. The heat accumulates to an astonishing degree when the wind passes over extensive deserts of burning sand, which are said in some instances, in Africa, to be heated to the boiling point. This fine sand, or rather dust, sometimes rises in the air and obscures it like a fog, communicating to it an intolerable heat. In Arctic countries the temperature is very much regulated by the freezing of the water and the melting of the ice; by the freezing of the water great quantities of heat are given out, which

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moderate the severity of the winter's cold, and thus save from destruction the Arctic land animals and plants; while in summer, the intensity of the heat, produced by the long continuance of the sun above the horizon, is moderated by the abstraction of a considerable portion of that heat by the water during the melting of the ice. Had the Arctic regions been entirely of land, neither plants nor animals could have existed in them: for during summer, owing to the sun remaining above the horizon for months, an elevation of atmospheric temperature would have been produced fatal to animals and plants; and in winter, the long darkness and intense cold would have proved equally fatal to animated beings. The cold of the icy regions of the north has been alleged to reach southern latitudes, by currents of air, and thus to lower their temperature.

METEOROLOGY.*

THE ATMOSPHERE. — The air in which we breathe, with the clouds and vapors floating in it, surrounds the earth on all sides to an unknown height, and forms a movable envelope denominated the *atmosphere*. The human species and other land animals, being thus entirely immersed in this fluid, may with some propriety be said to inhabit an ocean as really as the fishes which live in the great deep. But the latter have the advantage in being able to mount up, remain,

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* For a fuller view of Meteorology, see "Glance at the Sciences."

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or descend, at pleasure, in their element; whereas, without some additional aid, we must content ourselves with the more humble allotment of remaining on the bottom of our ocean. The winged tribes, doubtless, have the power of ascending to great heights; still they can never reach the summit.

There is nothing more essential to the existence or health of man himself, or of the inferior animals and vegetables which live on our globe, than the atmosphere; nor has any agent a greater share in the innumerable changes which are daily taking place in the inanimate materials composing our planet. That it is a body or substance possessing the essential properties of matter appears from the resistance which it offers to the occupation of its place by other bodies. Thus, if an apparently empty glass jar be inverted, and then immersed in a vessel of water, that liquid will only enter a very little way into the jar, the rest being occupied by the air. This familiar experiment shows that air is a body, by its resisting the entry of the water. At the same time, it shows the air to be an elastic or compressible substance, otherwise it would have completely excluded the water. That it is a fluid is evident from the ease with which bodies move in it, from its pressing equally in every direction, and passing with great facility through minute openings.

In respect to the composition of the atmosphere, vague and fanciful notions prevailed for many ages. The ancients considered it as one of the four simple elements of which they supposed all other bodies to be compounded. These were earth, air, fire, and water. How far the opinion was correct which made fire an

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element is a question on which nothing is yet known; but the researches of modern chemistry have shown that the other three are all compound bodies. The chief, and perhaps the only essential component substances in the atmosphere, are the two gases called oxygen and azote; its other ingredients, occurring only in small and variable quantities, are rather to be considered as foreign bodies.

Dew. — This is a remarkable product of atmospheric moisture. The quantity of aqueous vapor which can exist in a given space, as a cubic foot, is generally believed to be the same, whether there be air present in the space, or nothing but the vapor alone. The quantity is always the same at the same temperature, but it is greater as the temperature is higher; and, therefore, supposing the space to be saturated with vapor at a particular temperature, a portion of this will return into drops of water whenever the temperature falls. It is on this principle that a cold body, such as a bottle of liquor, being carried into a warm, moist apartment, becomes bedewed on the outside, till, perhaps, the water trickles down its sides; the contact of the cold surface chills the air, which in return deposits a portion of its moisture. Now this is similar to the mode in which moisture is insensibly deposited from the atmosphere on bodies at the earth's surface, and which is known by the name of dew. All bodies placed in still air, and exposed to the aspect of a clear sky, are found to become colder than they would be if some screen or awning were interposed between them and the sky. In such circumstances, bodies become much colder than the surrounding air, which, if sufficiently moist,

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deposits on them a portion of its moisture or dew. When the temperature is low, the dew is frozen and forms *hoar-frost*.

Dew never occurs in nights both cloudy and windy; and if, in the course of the night, the weather from being serene should become dark and stormy, dew which had been deposited will disappear. In calm weather, more dew will appear if the sky be partially covered with clouds than if it were quite clear. It often happens, that, even before sunset, dew begins to adhere to grass in spots which are sheltered from both sun and wind; for in clear weather such spots suffer much from the chilling aspect of the sky, and may often continue to acquire dew during the whole night, and for some time after sunrise. The quantity of dew depends on the moisture of the air, being greater after rain than after long continued dry weather.

Clouds. — Regarding the mode in which clouds are suspended in the air, philosophers are not agreed. About the commencement of the last century, it was supposed that the aqueous particles of clouds were in the form of hollow shells, specifically lighter than the air in which they float. But as no evidence or probability could be adduced in favor of this theory, it has given place to other speculations; and, at present, we may consider the suspension of clouds as an electrical phenomenon.

Rain, Sleet, Hail, &c. — As a greater quantity of moisture can exist in a given space as the temperature is higher, it is plain that there is a certain temperature at which air containing some moisture will just be saturated, and which is called the point of deposition, or the

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dewing point; for if cooled the least beyond this the air will deposit moisture. When the cooling in the body of air below the dew point is very slight, the effect is merely to disturb the transparency, or produce a fog. In the case of dew, formally considered, the transparency is not affected; because it is not the *mass* of air that is cooled below the point of deposition, but only a minute portion of it that comes into contact with surfaces cooled by radiation. When the cooling of a body of air beyond the dew point is considerable, the water is deposited more copiously, and, collecting into drops, descends to the earth in the form of *rain;* or if the temperature be sufficiently low, the drops are partially frozen, and form *sleet;* if fully frozen, *snow;* and if such drops be large and compact, they receivd the appellation of *hail.*

Rain is very unequally distributed to the different regions of the globe; but nature has so arranged it, that it is most copious in those latitudes where evaporation is most rapid. There are, however, exceptions to this rule; for on several tracts of the earth's surface, it hardly ever rains. These are usually far inland, ane are generally extensive plains, utterly sterile and uninhabitable. The want of rain is in some places partially supplied by the copious deposition of dew. On the contrary, there are some spots where it always rains, and which are mostly on the sea. As the whole atmosphere when fully charged with humidity is calculated to hold no more water than would form a sheet five inches in depth, while the mean annual deposit is about thirty-five or forty inches, it is plain that the supply must be frequently renewed. Rain is more abundant

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toward the equator than the poles, — at the sea-coast than towards the interior, — and on elevated stations than on plains.

GLACIERS. — Ice and snow absorb a large portion of heat during liquefaction, which they give out again on freezing; for, in the ordinary process of nature, water does not cool below 32° Fahrenheit, till the whole be frozen; nor does its temperature rise above that point, while in contact with ice and snow, — that is, till the whole be melted. This property has an important effect on the temperature of snowy districts. It retards and often prevents the occurrence of extreme cold, and it opposes a sudden rise of temperature above the freezing point. The cold in the atmosphere, as was formerly stated, continually increases with the elevation; and at a certain height, depending on the climate or latitude, perpetual frost prevails. Where the earth's surface attains this height, it is, with the exception of some steep or vertical cliffs, continually covered with snow. The snow acquires new additions from time to time; for though it may melt slowly, from the heat of the ground on which it rests, yet it suffers little decay externally, except what the air carries off by evaporation. The warmth of the solar rays may soften it a little, but this only tends to its farther consolidation. Masses of this soil are called *glaciers*.

By accumulating in the manner just mentioned, they often become top-heavy, or acquire such an enormous weight as to break their hold or crush their lower parts, which are besides liable to be undermined by the warmth of the mountain on which they rest. Hence, it not unfrequently happens, that huge masses of ice,

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or conglomerated snow, slide or roll down the sides of mountains, transporting, perhaps, large stones or fragments of rocks to which they had adhered, or which had been separated from their beds by the agency of the weather. Detached glaciers often descend into districts having a mean temperature considerably above the melting point of snow. But so great is the heat consumed in liquefying such huge masses, that years may elapse before they entirely disappear; and during that interval others descend; and so on continually, so that the limit of perpetual snow may be found in a climate where little snow falls from the clouds. When glaciers descend into the sea, and particularly when detached and floating, they are termed *icebergs*.

THE RAINBOW is a circular image of the sun, variously colored and produced thus: — The solar rays, by entering the drops of falling rain, are refracted to their farther surfaces, and thence, by one or more reflections, transmitted to the eye. But on escaping from the drop they undergo a second refraction, by which the rays are separated into their different colors; and in this state are exhibited to an eye properly placed to receive them. The rainbow is never seen but when rain is falling, and the sun and bow are always on opposite sides of the observer.

LOOMING, &c. — This is the term used by sailors to express a curious optical deception by which objects come into view, though materially altered as to their real situation or position. The French call it *mirage*, and the Italians *Fata Morgana*. It often happens at sea, that a distant ship appears as if painted in the sky, perhaps in an inverted position, and not supported by

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the water. Sunken rocks and sands appear as if raised above the surface. The Swedes long searched in vain for an illusory island of this sort, which they saw from a distance, as if placed between the isles of Aland and the coast of Upland. The shipping and the buildings on the shore of Naples have, from Messina, sometimes appeared floating inverted in the air. In 1798, the French coast appeared distinctly raised above the sea, for an hour, as viewed from the opposite shore of Sussex. To the French, while marching in the Egyptian deserts, the sandy plain, covered in the distance by a dense vapor, presented the illusive image of a vast lake, towards which they hastened, but never could reach it.

Aurora Borealis, or northern light, is a remarkable luminous phenomenon which occurs during night, and most commonly in clear or frosty weather. It is unknown in low latitudes, and becomes more frequent as we recede from the equator. But it is doubtful if its maximum either as to frequency or brilliancy be at the pole, for in the late north-polar expedition it was seen to the south of the observer, whereas, at greater distances from the pole, it appears to the north, or a little to the west of north, of the spectator. It is usually of a reddish color, inclining to yellow, and sends out frequent coruscations of pale light, which seem to rise from the horizon in pyramidal, undulating forms, and shoots with great velocity towards the zenith. Some maintain that a whizzing noise accompanies this phenomenon, but this is not very well ascertained.

St. Elmo's Fire is a faint light which seems to adhere to the points of bodies carried swiftly through

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the air. It appears on the tops of ship-masts, and at the points of spears and other warlike instruments when in motion. It is generally believed to be an accumulation of electric matter. A single flame of this sort was called by the ancients *Helena*. When seen in pairs, they were called *Castor and Pollux*.

Fire-Balls are those luminous bodies which appear usually at a great height above the earth, and were on that account long known by the term *meteor*, which is now applied to many other aerial phenomena. They present a very imposing appearance, and are seen of an immense size, sometimes red, but oftener of a vivid, dazzling white. They traverse the atmosphere with amazing velocity. This, and their great height, have been inferred from their being seen from various distant places, almost at the same instant; sometimes, they burst in pieces, or discharge torrents of flame, with a detonation making both the air and earth to tremble. Some of these balls descend like lightning, break through roofs of buildings, destroy animals, and shatter vessels at sea; in short, they are often attended with all the disastrous effects of thunder and lightning, with which they are occasionally accompanied. Some consider these balls to be great masses of electric matter passing from one place to another; others suppose them to be the same with the *aerolites*.

Aerolites, or meteoric stones, have frequently descended from the atmosphere, from the remotest antiquity. Both the above opinions may be correct, inasmuch as the fire-balls exhibit very different appearances. Philosophers are very much divided regarding the origin of meteoric stones. Some imagine

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	Miles.
Arkansas,	1,300
Rio Bravo del Norte,	1,250
Connecticut,	310
Hudson,	300
Delaware,	275

IN EUROPE.

Volga,	1,900
Danube,	1,630
Rhine,	890
Rhone,	540
Tagus,	520
Seine,	480
Po,	390
Thames,	240
Tiber,	210

IN AFRICA.

Nile,	2,750
Niger,	2,300
Congo,	1,400
Senegal,	850

IN ASIA.

Yenesei,	2,900
Yangste Kiang,	2,700
Obi,	2,800
Ganges,	1,350
Euphrates,	1,360
Ural,	1,050

CATARACTS.—When a river bed suddenly changes its level, so that the stream is plunged down a consider-

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able distance, a cataract, cascade, or fall is formed; when the change of the level is less abrupt, and the inclination is yet such as to render the current violent and broken, we give it the name of rapids.

Falls are generally formed by the descent of rivers or streams from primitive mountains to secondary countries; compact, durable rocks are requisite for producing a permanent effect of this kind; such are the cataracts of the Nile, the Ganges, and most other rivers.

Some cataracts, like those of Tunguska in Siberia, have gradually lost their elevation by the wearing away of the rocks over which they are precipitated, and have become merely rapids, and the same effect is produced in others by the gradual filling up of the gulf into which they plunge. "Cataracts," says Lamouroux, "must have been both more numerous and more lofty in the ancient world than they are at present. They are daily diminished both in number and height by the action of the universal leveller, time, and perhaps in some future age the cataracts of the Nile and the Ganges, the Falls of Niagara, and the cascades of Tequendama will be looked upon as a fiction of poetry."

Some of the most beautiful cataracts have been created, at least in part, by human labor. The celebrated *Cascata del Marmore* at Terni, "which," says Byron, "is worth all the cascades and torrents of Switzerland put together," is attributed to a work of Curius Dentatus, (270 B. C.,) who caused the rock to be cut through for the purpose of draining the marshes, and making an outlet for the Velino.

Some cataracts owe their celebrity to the vast vol-

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ume of water which is poured, in an unbroken sheet, over a great descent, as with Niagara; others are remarkable only for the vast height from which they fall, whether they plunge down the abyss at a single leap, or dash themselves successively from shelf to shelf till they reach the bottom of the precipice; some, falling in a small riband-like current over the edge of the rock, are dispersed before they reach the ground into thin spray, forming glittering showers of brilliants, or gaudy rainbows; others, driven forward by the force of the current, fall over in a continuous arch, between which and the bottom of the ledge from which they have fallen the visiter may pass; and yet others are visited and admired chiefly for the picturesque beauties of the glen, the grandeur of the precipices, or the gloomy horrors of the deep chasms which surround them.

"If it be difficult," says Humboldt, "to describe the beauties of cataracts, it is still more difficult to make them felt by the aid of the pencil. The impression they leave on the mind of the observer depends on the occurrence of a variety of circumstances. The volume of water must be proportioned to the height of the fall, and the scenery around must wear a wild and romantic aspect. The Pissevache and the Staubbach in Switzerland are lofty, but their masses of water are inconsiderable; the Niagara and the Falls of the Rhine on the contrary furnish an enormous column of water, but the height even of the former does not exceed one hundred and seventy feet. A cataract surrounded by hills merely produces much less effect than the waterfall which rushes into the deep and narrow val-

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leys of the Alps, and still more of the Andes. Independent of the height and body of the column of water, the figure of the landscape, and the aspect of the rocks, it is the luxuriant form of the trees and herbaceous plants, their distribution into groups or scattered thickets, the contrasts of the craggy precipices to the freshness of the vegetation, which give a peculiar character to these grand scenes of nature. The Niagara, which in a northern sky is in the region of oaks and pines, would be still more beautiful were its drapery composed of heliconias, palms, and arborescent ferns."

REMARKABLE FALLS IN EUROPE.

Name.	Height in feet.
Gavarnie, France, Pyrenees,	1,350
Fugloe, Isle of Fugloe, Norway,	1,000
Staubbach, Switzerland,	960
Doby Myllin, Wales,	900
Ginfael, Wales,	900
Riukan Fossen, Norway,	800
Holme's Fall, Scotland,	800
Nant d'Arpenaz, Savoy,	800
Nemelsaskas, or Lulea, Lapland,	600
Gray Mare's Tail, Scotland,	350
Pissevache, Switzerland,	300
Terni, or Velino, Roman States,	300
Acharn, Scotland,	240
Fyers, do.	212
Reichenbach, Switzerland,	200
Devil's Bridge, Switzerland,	100
Schaffhausen, do.	80
Tivoli, Roman States,	50

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REMARKABLE FALLS IN AMERICA.

Name.	Country.	Height in feet.
Tequendama,	New Grenada,	580
Pusambio, or Purace,	New Grenada,	400
Montmorency,	Canada,	250
Falling Spring,	United States,	200
Cauterskill,	do.	175
Niagara,	do.	170
Tauqkanic,	do.	160
Great Falls,	do.	150
Chaudière,	Canada,	100
Missouri,	United States,	90
Guanacualtan,	Mexico,	80
Passaic,	United States,	70
Cahoes,	do.	60
St. Anthony's,	do.	40
Glenn's,	do.	40

This is far from being a complete list even of the most remarkable waterfalls of these two continents; but it has been found quite impossible to give the dimensions of many striking cataracts, particularly in America, with any approach to accuracy; — nor have the highest known falls been mentioned here, because they are nothing more than the merest rills, and seldom offer any peculiar interest. Thus the little stream of Ache in Bavaria throws itself over an elevation of 2,000 feet, and there is said to be a cascade of equal height in the island of Nukahiva.

Remarable Falls in Asia. — Some of the most remarkable cataracts of Asia, with which we are acquainted, are the Fall of Garispa, in the Indian Ghauts, 1000 feet high; the Birra Chuki, 100 feet, and the

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Ganga Chuki, 200 feet, in the Cauvery; and those of Bilohi, 400, Chachai, 362, Tonse, 200, and Booti, 400 feet in height, in Bundelcund. There are many beautiful and magnificent cascades in the Ghauts, and the Ganges, Indus, and Brahmapootra exhibit many falls which have not been described.

The Cataracts of the Nile, so much celebrated by the ancients, have an elevation of not more than ten or twelve feet.

The Falls of Niagara have been found to be gradually receding from Lake Ontario; this great body of water is hurled over a ledge of hard limestone, below which is a layer of soft shale, which decays and crumbles away, so that the superincumbent limestone is left without a foundation, and falls from time to time in large masses. The bed of the river below the falls is strewed over with the huge fragments that have been thus detached and plunged into the abyss. Within the last forty years the Falls have receded nearly fifty yards, and there is little doubt that they were once at Queenstown, about seven miles below their actual site. Should they continue to recede at the rate above stated, or a little more than one yard annually, it will be 30,000 years before they reach Lake Erie.

The following beautiful description of this stupendous cataract, written by the late F. W. P. Greenwood, will be read with interest.

"There is a power and beauty, I may say a divinity, in rushing waters, felt by all who acknowledge any sympathy with nature. The mountain stream, leaping from rock to rock, and winding, foaming, and glancing through its devious and stony channels, arrests the eye

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of the most careless or business-bound traveller, sings to the heart and haunts the memory of the man of taste and imagination, and holds, as by some undefinable spell, the affections of those who inhabit its borders. A waterfall of even a few feet in height will enliven the dullest scenery, and lend a charm to the loveliest; while a high and headlong cataract has always been ranked among the sublimest objects to be found in the compass of the globe.

"It is no matter of surprise, therefore, that lovers of nature perform journeys of homage to that sovereign of cataracts, that monarch of all pouring floods, the Falls of Niagara. It is no matter of surprise, that, although situated in what might have been called, a few years ago, but cannot be now, the wilds of North America, five hundred miles from the Atlantic coast, travellers from all civilized parts of the world have encountered all the difficulties and fatigues of the path, to behold this prince of waterfalls amidst its ancient solitudes, and that, more recently, the broad highways to its dominions have been thronged. By universal consent, it has long ago been proclaimed one of the wonders of the world. It is alone in its kind. Though a waterfall, it is not to be compared with other waterfalls. In its majesty, its supremacy, and its influence on the soul of man, its brotherhood is with the living ocean and the eternal hills.

. . . . .

"From Waterloo we pass on by a level road, immediately on the western bank of the Niagara, and observe that the river continually becomes wider, till at length it divides into two streams, which sweep round

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an island several miles in length. They then unite again, forming one stream as before, only that it is increased in breadth and swiftness. And now the interest thickens, and begins to grow intense. Hitherto we had been travelling on the side of a large river, it is true, but one not much distinguished otherwise, either by its motion, its shape, or the beauty of its borders. We are obliged to call on ourselves to consider where we are, and whither we are going; for Niagara itself seems unconscious of the grand associations with which it is freighted. It moves as if unmindful, or as not caring to put the traveller in mind, that its waters have come down through the whole length of Erie from the far away Huron, Michigan, Superior; that they are just about to rush over the wondrous precipice below, and then are to hasten forward into another majestic lake, and from it are to pass through the portals of a thousand islands, and the alternate rapids and lakes of a noble and romantic river, washing the feet of cities, and so to flow on into the all-receiving sea. We are obliged to remember this, I say; for the unpretending waters, though pressing forward continually and intently, have thus far told us nothing, themselves, of their long pilgrimage behind, or the yet more eventful journey before them. But here, as they are meeting round Grand Island, they break their silence and speak, and the whole scene becomes full of spirit and meaning. Here, about three miles from the Falls, you see the white-crested rapids tossing in the distance before you. Here, even in the most unfavorable state of the weather, you hear the voice of the cataract, pervading the

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air with its low, monotonous, continuous roar. And here you see a column of mist rising up, like a smoke in distantly burning woods, and designating the sublime scene over which it is immediately hanging. I know not that I was afterward more strongly affected, even by the Falls themselves, than I was by the sight of this ever changing and yet never absent guide, this cloudy pillar, this floating, evanescent, and yet eternal testimony, which pointed out to me the exact spot which had been for so many years a shrine to thousands, which I had heard of and read of so long, and which I had myself so often visited, though not in person, yet with my reverential wishes, with my mind, and with my heart. Childhood came back to me, with its indistinct, but highly wrought and passionate images; maps were unrolled; books were opened; paintings were spread; measurements were recalled; all the efforts which the art of man had made, all the tributes which his spirit had offered, at the call of the great cataract; all these associations, with other dream-like thoughts of the wilderness, the lake, and the stream, rose up unbidden and with power within me, as I steadfastly regarded that significant, far-off mist, and knew that I, too, was soon to stand on the consecrated spot, and see, and feel.

"A mile or two is soon passed, and now we turn a little from the road to the right, in order to have a near view of the rapids. These occupy the whole breadth of the river, from shore to shore, and extend half a mile back from the Falls, and are formed by the rush of the entire body of waters down a rough bed, the descent of which in the course of this half mile is

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fifty feet. Here all is tumult and impetuous haste. The view is something like that of the sea in a violent gale. Thousands of waves dash eagerly forward, and indicate the interruptions which they meet with from the hidden rocks by ridges and streaks of foam. Terminating this angry picture, you distinguish the crescent rim of the British Fall, over which the torrent pours, and disappears. The wilderness and the solitude of the scene are strikingly impressive. Nothing that lives is to be seen in its whole extent. Nothing that values its life ever dares venture it there. The waters refuse the burden of man, and of man's works. Of this they give fair and audible warning, of which all take heed. They have one engrossing object before them, and they go to its accomplishment alone.

"Returning to the road, we ride the last half-mile, ascending gradually, till we come to the public house. A footpath through the garden at the back of the house, and down a steep and thickly wooded bank, brings us upon Table Rock, a flat ledge of limestone, forming the brink of the precipice, the upper stratum of which is a jagged shelf, no more than about a foot in thickness, jutting out over the gulf below. Here the whole scene breaks upon us. Looking up the river, we face the grand crescent, called the British or Horseshoe Fall. Opposite to us is Goat Island, which divides the Falls, and lower down to the left is the American Fall. And what is the first impression made upon the beholder? Decidedly, I should say, that of beauty; of sovereign, majestic beauty, it is true, but still that of beauty, soul-filling beauty, rather

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than of awful sublimity. Every thing is on so large a scale; the height of the cataract is so much exceeded by its breadth, and so much concealed by the volumes of mist which wrap and shroud its feet; you stand so directly on the same level with the falling waters; you see so large a portion of them at a considerable distance from you; and their roar comes up so moderated from the deep abyss, that the loveliness of the scene, at first sight, is permitted to take precedence of its grandeur. Its coloring alone is of the most exquisite kind. The deep sea-green of the centre of the crescent, where it is probable the greatest mass of water falls, lit up with successive flashes of foam, and contrasted with the rich, creamy whiteness of the two sides or wings of the same crescent; then the sober gray of the opposite precipice of Goat Island, crowned with the luxuriant foliage of its forest trees, and connected still further on with the pouring snows of the greater and less American Falls; the agitated and foamy surface of the waters at the bottom of the Falls, followed by the darkness of their hue as they sweep along through the perpendicular gorge beyond; the mist, floating about, and veiling objects with a softening indistinctness; and the bright rainbow which is constant to the sun, — altogether form a combination of color, changing, too, with every change of light, every variation of the wind, and every hour of the day, which the painter's art cannot imitate, and which nature herself has perhaps only effected here.

"And the motion of these Falls, how wonderfully fine it is! how graceful, how stately, how calm! There is nothing in it hurried or headlong, as you

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might have supposed. The eye is so long in measuring the vast, and yet unacknowledged height, that they seem to move over almost slowly; the central and most voluminous portion of the Horseshoe even goes down silently. The truth is, that pompous phrases cannot describe these Falls. Calm and deeply-meaning words should alone be used in speaking of them. Any thing like hyperbole would degrade them, if they could be degraded. But they cannot be. Neither the words nor the deeds of man degrade or disturb them. There they pour over, in their collected might and dignified flowing, steadily, constantly, as they always have been pouring since they came from the hollow of His hand, and you can add nothing to them, nor can you tak any thing from them.

"As I rose, on the morning following my arrival, and went to the window for an early view, a singular fear came over me that the Falls might have passed away, though their sound was in my ears. It was, to be sure, rather the shadow of a fear than a fear, and reason dissipated it as soon as it was formed. But the bright things of earth are so apt to be fleeting, and we are so liable to lose what is valued as soon as it is bestowed, that I believe it was a perfectly natural feeling which suggested to me for an instant, that I had enjoyed quite as much of such a glorious exhibition as I deserved, and that I had no right to expect that it would continue as long as I might be pleased to behold. But the Falls were there, with their full, regular, and beautiful flowing. The clouds of spray and mist were now dense and high, and completely concealed the opposite shores; but as the day advanced, and the

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beams of the sun increased in power, they were thinned and contracted. Presently a thunder-shower rose up from the west, and passed directly over us; and soon another came, still heavier than the preceding. And now I was more impressed than ever with the peculiar motion of the Fall; not, however, because it experienced a change, but because it did not. The lightning gleamed, the thunder pealed, the rain fell in torrents; the storms were grand; but the Fall, if I may give its expression a language, did not heed them at all; the rapids above raged no more and no less than before, and the Fall poured on with the same quiet solemnity, with the same equable intentness, undisturbed by the lightning and rain, and listening not to the loud thunder.

"About half a mile below the Horseshoe Fall, a commodious road has lately been cut in a slanting direction, down the side of the perpendicular cliff, and through the solid rock, to the river. Here we find a regular ferry, and are conveyed in a small boat across the stream, which is now narrowed to a breadth of about twelve hundred feet, to the American side. The passage is perfectly safe, and, though short, delightful, as it affords a superb view of both the Falls above, and of the dark river below. The current is not very rapid, and near the American side actually sets up toward the Falls; by the help of which eddy the boat regains what it had lost in the middle of the stream. We land almost directly at the feet of the American Fall, and by walking a little way to the right, may place ourselves in its spray. Now look up, and the height will not disappoint you. Now attend to the

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voice of the cataract, and it will fill your soul with awe. It seems as if the 'waters which are above the firmament' were descending from the heights of heaven, and as if 'the fountains of the great deep were broken up' from below. The noise, which permits free conversation to those who are on the bank above, is here imperative and deafening. It resembles the perpetual rolling of near thunder, or the uninterrupted discharge of a battery of heavy ordnance, mingled with a strange crashing and breaking sound. This resemblance to the roar of artillery is heightened by the sight of the large bodies of spray, which are continually and with immense force exploded from the abyss. The impression of superior height is gained, not so much from the fact that the American Fall is actually ten or twelve feet higher than the British, as from your having a complete *profile* view of the one, from brink to base, which you cannot well obtain of the other.

"Flights of secure wooden steps bring us to the top of the bank, where we again stand on a level with the descending Falls. We soon found that the greatest variety of interest was on this, the American side. The village of Manchester is situated on the rapid, just above the Fall. A bridge is thrown boldly over the rushing and 'arrowy' rapid to a small island, called Bath Island, where there are one or two dwellings and a paper-mill; and from this spot another bridge runs with equal boldness to Goat Island. The whole breadth of the space thus traversed is one thousand and seventy-two feet.

"Goat Island is a paradise. I do not believe that

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there is a spot in the world, which, within the same space, comprises so much grandeur and beauty. It is but about a mile in circumference, and in that mile you have a forest of tall old trees, many of them draped with climbing and cleaving ivy; a rich variety of wild shrubs and plants; several views of the rapids; an opportunity to pass without discomfort under the smaller American Fall, and the very finest view, I will venture to say, of the great Crescent, or Horse-shoe Fall. Turn to the left, as you enter this Eden, and you come out into a cleared and open spot, on which you discern a log-hut, with vines round its door and windows, and a little garden in front of it, running down to the water's edge; a flock of sheep feeding quietly, or reposing pleasantly, under scattered clumps of graceful trees; while, beyond this scene of rural repose, you see the whole field of the rapids, bearing down in full force upon this point of their division, as if determined to sweep it away. Or, turn to the right, and threading the shady forest, step aside to the margin of the smaller American Fall, and bathe your hands, if you please, in its just leaping waters. Then, pursuing the circuit of the island, descend a spiral flight of stairs, and, treading cautiously along a narrow footpath, cut horizontally in the side of the cliff, enter the magnificent hall formed by the falling flood, the bank of which you have just left, and command your nerves for a few moments, that, standing as you do about midway in the descent of the Fall, you may look up, eighty feet, to its arched and crystal roof, and down, eighty feet, on its terrible and misty and resounding floor. You will never forget that sight and sound.

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"Retrace your steps to the upper bank, and then, if your strength holds out, proceed a short way further, to the enjoyment of a view, already referred to, which excels every other in this place of many wonders. It is obtained from a bridge or platform, which has recently been thrown out over some rocks, and is carried to the very brink of the Horseshoe Fall, and even projects beyond it; so that the spectator, at the end of the platform, is actually suspended over it. And if he is alone, and gives way to his feelings, he must drop upon his knees, for the grandeur of the scene is overpowering. The soul is elevated, and at the same time subdued, as in an awful and heavenly presence. Deity is there. The brooding and commanding Spirit is there. 'The Lord is upon many waters.' The heights and the depths, the shadows and the sunlight, the foam, the mist, the rainbows, the gushing showers of diamonds, the beauty and the power and the majesty all around and beneath, environ the spirit with holiest influences, and without violence compel it to adore. 'Deep calleth unto deep.' The cataract, from its mysterious depths, calleth with its thunder, back to the deep lake, and up to the deep sky, and forward to the deep ocean, and far inward to the deep of man's soul. And the answer of the lake, and the answer of the sky, and the answer of the ocean, are praise to the Maker, praise to Him who sitteth above the waterflood, praise to Amighty God! And where is the soul, which will not also hear that call, and answer it even with a clearer and louder answer, and cry, 'Praise to the Creator, praise to the infinite and holy and blessed God!'"

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Springs. — These are formed by the percolation of waters through the earth and rocks, which descend from higher to lower levels, and flow out at openings which they find or force for themselves. They are almost all impregnated with some foreign ingredients, which render them more agreeable to the taste, and more nutritious, than pure rain-water. But it is only those waters which contain such a portion of foreign matter as gives them a sensible flavor, and a specific action upon the animal economy, to which we give the name of mineral waters.

The number of metals, earths, acids, and alkalis, held in solution by different springs, comprehends almost all known substances; but the most common and abundant are lime, iron, magnesia, silica, alumine, soda, and the carbonic and sulphuric acids.

Mineral springs are divided, in respect of temperature, into the cold and the thermal or warm springs. In regard to their ingredients, they are commonly divided into four classes; the acidulous or carbonated; the saline; the chalybeate or ferruginous; and the sulphureous.

Those waters which contain carbonic acid in its free state, or in combination in excess with a base, are called acidulous or carbonated waters. They are distinguished by their slightly acid taste, and by their sparkling when they are poured from one vessel to another; both of which properties they lose on exposure to the air. Beside carbonic acid they generally contain common salt, and some of the earthy carbonates.

To this class of waters belong those of Vichi and Mont d'Or in France; the famous Seltzer waters of

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Niederselters, in Nassau; the Carlsbad Springs in Bohemia; the Sweet Springs in Monroe county, Virginia, &c.

The sulphureous waters are impregnated with sulphuretted hydrogen. They are distinguished by their odor, and by their causing a piece of silver immersed in them to turn black. Beside sulphuretted hydrogen, they contain alkaline and earthy sulphates and muriates, and they may be subdivided into two kinds; those which have sulphuretted hydrogen in a free state, and those in which it is combined with an alkali or an earth. The general effects of these waters are stimulant, and they are more often used in the form of a bath than internally. They are serviceable in gout and rheumatism, in sprains and bruises, in cutaneous disorders, &c.

Among the sulphureous springs may be mentioned those of Aix-la-Chapelle, in Rhenish Prussia; of Enghien, in France; of Harrowgate, in England; of Moffat, in Scotland; the White Sulphur Springs of Greenbrier county, the Red Sulphur of Giles county, and the Salt Sulphur of Monroe county, Virginia; the Olympian Springs and the Blue Licks, in Kentucky, &c.

Chalybeate waters contain iron, and are known by their peculiar taste, and by their becoming black when mixed with an infusion of nutgalls. In some, the iron is combined with sulphuric acid, in more with carbonic acid; when this is in excess, the waters possess acid properties, and form acidulous chalybeate waters.

Chalybeate waters are tonic and aperient, and are used with advantage in cases of debility and chronic diseases. Among the most noted springs of this class

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are those of Tunbridge and Brighton, in England; of Spa, in Belgium; of Pyrmont, in Waldeck; the fourteen springs of Langenschwalbach, in Nassau; the springs of Ballston; Bedford, York, and Brandywine Springs, in Pennsylvania; the Yellow Spring, in Ohio, &c.

Saline waters are those which contain the saline ingredients generally found in mineral waters, but which have very little or no iron or sulphuretted hydrogen, and have not carbonic acid in excess. These are subdivided into alkaline, containing alkali in a free state, or combined with carbonic acid; hard waters, or those which contain carbonate or sulphate of lime; salt waters, in which salt abounds; and purgative waters, which contain chiefly sulphate of magnesia, or Epsom salt.

The most celebrated thermal saline waters are those of Bath, Buxton, and Bristol, in England; of Dunblane and Pitcaithley, in Scotland; Plombieres and Bourbon-Lancy, in France; Carlsbad and Teplitz, in Germany; Lucca and St. Julian, in Italy; and the Warm Springs of North Carolina.

Among the cold saline springs are those of Saratoga, in New York, and of Harrodsburg and Grenville, in Kentucky; Epsom and Cheltenham, Leamington, Scarborough, and Malvern, in England; and Sedlitz and Seidschutz, in Bohemia. When there is a considerable quantity of carbonic acid, they become more grateful to the taste, and when iron is present, as is sometimes the case, they acquire tonic and stimulant powers.

Thermal waters include individual springs of all the classes; a thermal spring being one which, whatever are its chemical properties, possesses a temperature more or less elevated above that of the region in

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which it is situated, and the changes of which do not coincide with those of the external atmosphere.

TABLE OF THERMAL WATERS.

Name.	Country.	Temperature.
San Pedro Dosal,	Portugal,	154°
Chaves,	"	142
Vic,	France,	212
Vichi,	"	115
Bourbon les Bains,	"	156
Teplitz,	Austria,	113
Carlsbad,	"	165
Wisbaden,	Nassau,	158
Schlangenbad	"	86
Aix-la-Chapelle,	Prussia,	136
Baden,	Baden,	154
Piscarelli,	Naples,	200
Geyser,	Iceland,	212
Buxton,	England,	82
Bristol,	"	74
Bath,	"	117
St. Michael,	Azores,	208
Hot Springs,	Arkansas,	212
Hot Springs,	Virginia,	112
Warm Springs,	North Carolina,	104
Sweet Springs,	Virginia,	73
Sans Souci,	New York,	50
Chichimaquillo,	Mexico,	205
St. Lucia,	West Indies,	203
Eaux Bouillantes,	Martinique,	131
Onoto,	Venezuela,	112
Trincheras,	"	195
Cuenca,	Equator,	162

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LAKES. — A lake is an inland body of water not connected with the ocean or any of its branches. In regard to the position of their beds, there are two classes of lakes; those formed in deep hollows among the mountains, and fed by springs or torrents; and those formed in level countries by the surplus water of rivers or in consequence of the want of a general declivity in the ground. Thus there is a system of the former class in the great Alpine girdle of the old continent, including the lakes of the Pyrenees, the Alps, the Apennines, and those of the Taurus, Caucasus, and Altaic chains; to the north of this great mountain band are the numerous lakes of the vast Northern plain of Europe and Asia, belonging to the latter class, and comprising the numerous lakes of Prussia, Sweden, Russia, and Siberia; to the south of the mountainous zone, in Africa, for instance, the lakes are few.

There is a similar disposition in the New World; a chain of mountain lakes accompanies the Andes through their whole course, including Titicaca, Nicaragua, Chapala, the small lakes of the Mexican valley, Timpanogos, &c., and while the great eastern plains of South America are nearly destitute of them, the regions around the Hudson contain an astonishing number of lakes, corresponding in number, character, and geographical situation to those which skirt the shores of the Baltic and the Frozen Ocean.

Another division of lakes is founded upon the manner in which they receive or discharge their waters, and in this point of view they form four classes: — 1. Those which receive streams of water, and have an outlet to the ocean are the most numerous and extensive. 2. Those which receive rivers, without having any visi-

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ble outlet, such as the Caspian Sea, Lake Tchad, in the interior of Africa, &c. 3. Those which receive no running water, but have an outlet; these are fed by springs. 4. Those which neither receive running water, nor have an outlet; these are small.

Lakes are also distinguished, according to the quality of their water, into saline and fresh; those which have no outlet, and those situated in a region, whose soil is impregnated with salt, are of the latter class.

EUROPEAN LAKES.

	Sq. Miles.		Sq. Miles.
Ladoga, (Russia,)	6,350	Lake of Constance,	290
Wener, (Sweden,)	2,150	Lake of Ilmen,	275
Saima, (Finland,)	1,610	Garda,	180
Peipus, (Russia,)	850	Maggiore,	150
Wetter, (Sweden,)	850	Neufchatel,	115
Mæler, "	760	Lucerne,	100
Lake of Geneva,	340		

ASIATIC LAKES.

Aral,	9,930 (?)	Van,	1,960
Baikal,	7,540 (?)	Urmiah,	760
Palkati,	3,696	Dead Sea,	500

AFRICAN LAKES.

Lake Tchad,	(?)	Dembea,	(?)
Maravi,	(?)	Dibbie,	(?)

AMERICAN LAKES.

Superior,	35,000	Athabasca,	6,000
Huron,	20,000	Erie,	10,000
Great Bear Lake,	(?)	Ontario,	7,200
Winnipeg,	10,000	Titicaca,	6,500
Slave Lake,	12,000	Nicaragua,	5,000
Michigan,	16,000		

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The following lines, descriptive of the largest mass of fresh water in the world, may serve to direct the attention of the reader to this sublime and beautiful object, in the scenery of our own continent: —

LAKE SUPERIOR.

Father of lakes! thy waters bend
Beyond the eagle's utmost view,
When, throned in heaven, he sees thee send
Back to the sky its world of blue.

Boundless and deep, the forests weave
Their twilight shade thy borders o'er,
And threatening cliffs, like giants, heave
Their rugged forms along thy shore.

Pale Silence, 'mid thy hollow caves,
With listening ear in sadness broods,
Or startled Echo o'er thy waves
Sends the hoarse wolf-notes of thy woods.

Nor can the light canoes, that glide
Across thy breast like things of air,
Chase from thy lone and level tide
The spell of stillness, deepening there.

Yet round this waste of wood and wave,
Unheard, unseen, a spirit lives,
That, breathing o'er each rock and cave,
To all a wild, strange aspect gives.

The thunder-riven oak, that flings
Its grisly arms athwart the sky,
A sudden, startling image brings
To the lone traveller's kindled eye.

The gnarled and braided boughs, that show
Their dim forms in the forest shade,

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Like wrestling serpents seem, and throw
  Fantastic horrors through the glade.

The very echoes round this shore
  Have caught a strange and gibbering tone,
For they have told the war-whoop o'er,
  Till the wild chorus is their own.

Wave of the wilderness, adieu!
  Adieu, ye rocks, ye wilds and woods!
Roll on, thou element of blue,
  And fill these awful solitudes!

Thou hast no tale to tell of man, —
  God is thy theme. Ye sounding caves, —
Whisper of Him, whose mighty plan
  Deems as a bubble all your waves!

THE OCEAN. — This may be described as a sheet of water, resting in the hollows of the solid structure of our planet, and covering not less, probably, than two thirds of the entire surface. From calculations, its greatest depth is believed to be about 30,000 feet, or between four and five miles, which, it may be remarked, is near the greatest height of any land above the surface of the ocean. But the greatest depth which has been ascertained by actual measurement is not more than 5000 feet; for such is the pressure and density of the liquid mass at that depth, that no sounding-lead, or apparatus possessed by mariners, can possibly be made to sink below that point from the surface.

The quantity of water composing the ocean, by the unalterable laws of evaporation and condensation, remains always at a fixed point, there being neither increase nor decrease. It has been remarked by Laplace, that

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if the existing waters of the ocean were increased only one fourth, the earth would be drowned, with the exception of some of the highest mountains; and that if, on the other hand, the waters were diminished in the same proportion, the largest rivers would dwindle to the capacity of brooks, and some of the principal arms of the sea would entirely disappear, while at the same time the earth would be deprived of its due proportion of humidity, and the face of nature be dried up and rendered desolate. Broad, therefore, as are the limits of the ocean, they are only in exact agreement with the wants and arrangements of nature in the habitable portion of the globe, and as such afford a convincing testimony of the power, wisdom, and goodness of the Divine Creator.

The bottom or bed of the ocean is marked by the same irregularities of surface as the dry ground. It consists of heights and hollows, rocky protuberances and caverns, hills and vales, sandbanks and reefs, of every imaginable form and extent. Like the land, also, it bears a luxuriant vegetation, consisting of plants of various kinds, all of which are exactly suited to their respective situations. The sea has likewise its tribes of animals, from the huge whale down to the minute coral insect, by whose incessant labors the hardest rocky substances are constructed and reared to the surface of the waters. When the more elevated protuberances in the bed of the ocean are raised above the surface level, they assume, as is well known, the character of islands, and when of a large size, of continents. Thus, the tracts of dry land are in one sense the tops of mountains rising from the bosom of the deep. How islands

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are formed, sometimes by the action of volcanoes bursting upwards in showers of lava in the midst of the sea, and sometimes by the gradual accumulation of matter deposited by coralline insects; and also how tracts of land are added to continents, and also sometimes taken from them, by the influence of currents, rivers, and other natural causes, are explained by geology.

TIDES. — The waters of the sea may exhibit to the eye a calm, unruffled surface, when not agitated by winds, but they are never altogether still. Their ceaseless motion, which has the important effect of preserving them from stagnation, is caused by two great risings and depressions, or flowings and ebbings, of the waters, in the course of twenty-four hours, known by the name of tides. The two tides or flowings of the sea are experienced daily all over the globe, though in some seas, from peculiar local causes, they are less powerful than in other places. It is not a little remarkable, that the condition of high water or full tide occurs at directly opposite sides of the earth at the same time. When it is high water at longitude 0, it is also high water at longitude 180, and so on with every other two opposite points of the earth, on the same parallel of latitude.

It has been ascertained, beyond all reasonable doubt, that the tides are caused by the attractive influence of the moon. By the universal law of attraction or gravitation, all masses of matter have a tendency to be attracted or drawn towards each other. The moon, therefore, as a mass of matter, in passing round the earth, has a tendency to draw the earth after it, or out of its natural relative position, and it really does so to a small extent. As it passes round, it draws up the

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waters in a protuberance, or, in common language, draws a huge wave after it. But it also draws the land beneath the protuberance, and so causes the opposite side of the globe to be drawn away from the ocean, leaving the waters there to form a similar protuberance, or high wave. In the one case, the water is drawn directly up or towards the moon; in the other, the water is in some shape left behind by the land being pulled away from it. In both, a similar effect is produced; two high tides are caused at opposite extremities of the earth. Where the higher part of either of these great billows strikes our coast, we have the phenomenon of high water; and when the lower touches us, it is low water. Each of the waves is brought over any given place in the circumference of the earth in twenty-four hours, so as to cause high water twice a day. The sun is also known to have a certain attractive influence on the waters of the ocean, but, from the great distance of that luminary, the effect is comparatively small. But when this minor influence of the sun coincides with that of the moon, or acts in the same way, we perceive a marked increase in the tides; on such occasions we have what are called *spring* or *large* tides. When the solar and lunar attractions act in opposition, we have *neap* or *small* tides. The spring tides happen twice a month, when the moon is at full and change; and the neap when the moon is in the middle of its orbit, between those two points.

A tide requires six hours to rise, which it does by small impulses or ripplings of the water on the shore, and six hours to ebb or fall; but every successive high water is from twenty to twenty-seven minutes later than

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the preceding, or, on an average, about fifty minutes for two tides, in consequence of the earth requiring that time above the twenty-four hours to bring any given point again beneath the moon. The tides are thus retarded by the same reason that the moon rises fifty minutes later every day. It is evident that the tides will be greatest at that point of the earth's surface which is nearest to the moon, or where the latter is vertical. She is so between the tropics; and accordingly the tides are there greatest, and they diminish as we approach either pole. It is further to be remarked, that the moon does not anywhere draw up the tides immediately. Three hours elapse before the waters are raised, in consequence of the law of *inertia*, or a disposition which every body has to continue in the condition of rest or motion in which it happens to be placed. This stubbornness to resist the moon's influence is only overcome by a three hours' action upon the waters; and thus the tidal wave is always three hours behind the moon in its passage.

Twice a year, namely, in March and September, the tides are higher than at other times, because then the attraction of the sun and moon are strongest. In some of the friths or arms of the sea on the east coast of Scotland, it has been occasionally noticed that there have been four high waters in the twenty-four hours. These, however, are not simple tides. The double risings are caused by the irregular passage of the tidal wave from the Atlantic round the north and south points of the island of Great Britain. When that portion of the wave which proceeds by the south reaches the east coast sooner than that by the north, or *vice versâ*, there will

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be two risings of the water instead of one. Similar phenomena may be observed in other parts of the earth. In the Mediterranean Sea the tides are small, and in some places scarcely perceptible; this is caused by the general confinement of that inland branch of the ocean by the Straits of Gibraltar, which prevent the full action of the tidal wave either in its rising or recession.

CURRENTS. — Besides being affected by the regular motion of the tides, the ocean, in many parts of its extended bounds, is influenced by currents, which act continually in particular directions. Currents are the result of various causes, such as temperature, winds, peculiar construction of coasts and inlets, but chiefly, as is believed, of the rotary motion of the earth. The globe in its diurnal motion leaves, as it were, the fluid behind; and hence there is a perpetual flow of the sea from the western coast of Europe and Africa towards the eastern *landboard*, as it is called, of America, and from the west of America to the eastern coast of Asia.

This movement is chiefly confined to the tropics, unless where the sea is turned aside by the land, and caused to diverge towards the north or south. If we start, in a survey of this motion, from the western coast of America, we find it producing a constant current across the vast expanse of the Pacific, till it is turned off by Asia and Australia. A great division of its force is directed through the seas on both sides of the latter continent, and so on through the Indian Ocean, and round the Cape of Good Hope, till it reaches the free expanse of the Atlantic, across which it proceeds in the same manner as across the Pacific. The current

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of the Atlantic strikes the coast of Brazil, and breaks at Cape St. Augustine into two divisions, one of which proceeds round Cape Horn into the Pacific, while the other advances through the Caribbean Sea, and so on into the Gulf of Mexico. This latter branch conspires, with the vast issue of fresh waters which pours into the Gulf of Mexico, to raise the level of that sea above that of the neighbouring ocean, and, causing the surplus to force its way out between Florida and Cuba, produces the celebrated Gulf Stream, which is perhaps the most powerful sea current in the world.

It is obvious, that to the mariner currents must be of great importance. From Portugal, for instance, ships have sailed to the Bight of Benin, on the Guinea coast, being 150 leagues, in two days, though they could not return in less than seven weeks. It is also common for vessels to descend to the latitude of the Canary Islands, in order to get into the tropical current across the Atlantic, which carries them to America in a comparatively short time: it was by this current that Columbus was carried so smoothly on in his first voyage to the new continent. The Pacific, it is said, can be crossed in this way in about ten weeks, being at the rate of a thousand miles per week; and some mariners have expressed an opinion that China might be reached by this route in less time than by the shorter course round the Cape of Good Hope.

For the same reason that the sea flows from east to west, the air has a tendency, when not counteracted by other causes, to move in the same direction. The earth in its motion leaves the air, like the sea, a little behind it; in other words, does not carry it so fast for-

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ward: hence what are called the trade winds, which, operating in the same direction with the sea currents, increase the facility of navigation to the westward in a very great degree. It is impossible to avoid remarking, that these natural phenomena, which, it is to be supposed, might have been counteracted or neutralized from the beginning, must have been designed for some end useful and necessary in the economy of the world. Perhaps, like the diffusive powers given to the seeds of certain plants, they were intended to aid in the dispersion of the human race over the globe. It is well known that population exists in many places, which appear cut off from all connection with others by seas that must have been impassable by navigators in the early ages of their art. Men could only be drifted to such places in early ages by the currents of the sea and air; and thus the cultivation of large and important regions must have commenced much earlier than would have otherwise been the case.

Besides the grand equatorial or tropical current, there is one of a less decided character from the poles to the equator. The sea under the tropics evaporates to a greater extent than elsewhere, by the influence of a vertical sun. The vapors are apt to proceed towards the north and south, where they descend in rain. A surplus of water is thus produced in the high latitudes, which naturally flows back towards the equator. Hence a constant but comparatively slight flow from the north and south towards that warmer region of the earth. Under the influence of this stream, large masses of ice are constantly becoming detached from the polar stores, and drifted to the tropics. In some of the bays on the

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north side of Iceland, this frigid substance comes in vast quantities, insomuch as to choke them up to the depth of 500 feet. What is still more strange, these masses of ice are sometimes mixed up with trees, some of which are known to be the produce of the torrid zone in America: this is accounted for by the action of the northern division of the great current which parts at Cape St. Augustine. That division, after rushing into and out of the Gulf of Mexico, proceeds northward to Newfoundland, and thence at a high latitude returns athwart the Atlantic, finally sweeping along the western coasts of Europe, and rejoining the current which gave its first impulse. By this current, it is supposed, American timber may easily be carried to the northern shores of Iceland.

The operation of the tides is less observable in the great currents we have alluded to, than in those which prevail in the more secluded seas. The abstraction of water from a secluded sea by the recess of the tide, and the rush inwards produced by its flow, are sufficient of themselves to cause very impetuous currents, more particularly in the narrow channels by which the inland seas are connected with the ocean. We find it stated, in a pamphlet respecting the condition of the Orkney Islands, that the Pentland Frith, which separates the continent of Great Britain from Orkney, "has no fewer than four-and-twenty contrary currents of the tide at the flood of spring, besides numerous sets and eddies, which, under the local names of *wells*, *swelches*, and *roosts*, boil more madly on the Orcadian shore, than ever did witch's caldron on the kindred coast of Norway, if we may believe old tradition and Bishop

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Pontoppedan. 'The Boar of Papa,' at the opposite extreme of Orkney, is another terrible tide; when he gets a vessel in his tusks, he shakes the masts out,—an operation which, in the country phrase, goes by the name of *hackling*."

The contrariety of influences which are sometimes brought into play by polar and equatorial currents, and those produced by the tides, occasion many phenomena extremely perplexing, and sometimes very dangerous, to the navigator. In the Cattegat, by which the Baltic is connected with the German Ocean, one current always goes in by the side next Jutland, while another issues forth by that nearest to Sweden. In like manner, a current seems to proceed along the eastern coast of Britain towards the south, while another, flowing in an opposite direction, advances along the coast of Holland. What is still more curious, under-currents are sometimes found going in a contrary direction to those upon the surface. At the Straits of Gibraltar, it is said there is always a surface current going in, as if to supply a want in the Mediterranean, while, at a certain depth, there is another going out. So strong and so steady is this contrariety in the Caribbean Sea, that a boat may be moored by dropping a heavy subtance to a certain depth; the upper current impels the boat one way, while the under one draws the sunk object another, and between the two the boat is steadied.

Two currents of equal force, but of different directions, meeting in a narrow passage or gut, will cause a whirlpool, a phenomenon which has ignorantly been said to be produced by subterranean rivers, gulfs,

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chasms, &c., but essentially is only an eddy, produced by the contact of two currents, meeting on a centre. The whirlpool named the Euripides, near the coast of Greece, alternately absorbs and rejects the water seven times in twenty-four hours. Charybdis, in the Straits of Sicily, absorbs and rejects the water thrice in twenty-four hours; and the Maelstrom, on the coast of Norway, which is considerably the largest, absorbs, every six hours, water, ships, whales, in short, every thing that approaches its malignant influence, and the next six hours is employed in casting them up again. These eddies are sometimes augmented by the force of contending tides, or by the action of the winds. They draw vessels along, dash them upon rocks, or engulf them in their furious vortices, the wreck not appearing until some time after.

WATERSPOUTS. — Marine waterspouts are caused by the action of atmospheric currents, and are as dangerous in their effects as they are wonderful in appearance. Malte Brun thus describes them: — "Underneath a dense cloud, the sea becomes agitated with violent commotions; the waves dart rapidly towards the centre of the agitated mass of water, on arriving at which they are dispersed into aqueous vapors, and rise whirling round in a spiral direction towards the cloud. This conical ascending column is met by another descending column, which leans towards the water, and joins with it. In many cases the marine column is from fifty to eighty fathoms in diameter near its base. Both columns, however, diminish towards the middle, where they unite; so that here they are not more than three or four feet in diameter. The en-

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tire column presents itself in the shape of a hollow cylinder, or tube of glass empty within. It glides over the sea without any wind being felt; indeed, several have been seen at once following different directions. When the cloud and the marine base of the waterspout move with unequal velocities, the lower cone is often seen to incline sideways, or even to bend, and finally to burst in pieces. A noise is then heard like the noise of a cataract falling in a deep valley. Lightning frequently issues from the very bosom of the waterspout, particularly when it breaks; but no thunder is ever heard."

Sailors, to prevent the imminent danger which their vessels would be exposed to by coming in contact with these tremendous columns, discharge upon them a cannon-ball, which, passing through them, causes them invariably to burst, and consequently removes all chance of injury connected with them. This phenomenon is accounted for in the following manner: — Two winds meet; a vortex ensues; any cloud which happens to lie between them is condensed into a conical form, and turned round with great velocity; this whirling motion drives from the centre of the cloud all the particles contained in it; a vacuum is thereby produced, and water, or any other body lying beneath this vacuum, is carried into it upon the usual and well known principle. The cannon-ball, breaking this cylinder, which is always partly hollow, causes it to fall to pieces, in the same manner as a touch upon the surface of a soap-ball reduces the resplendent mass to a drop of common water.

TEMPERATURE OF THE SEA. — The temperature of

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the sea, like that of the air, is liable to be affected by the latitude and the season of the year, but not to nearly so great an extent as the air. Within the tropics, where the season has hardly any influence, it is generally found at about 80° or 81° of Fahrenheit's thermometer, being somewhat more, in general, than the warmth of the neighbouring air, which is deprived to a certain extent of its heat, in order to carry on the process of evaporation. Taking the month of March as one of those during which the heat of the sun must be equally determined in both directions by latitude, it appears that in that month the sea has been found, at Lat. 11° 32′ S., of 80.6° Fahrenheit; at Lat. 31° 34′ S., of 75.7°; at Lat. 40° 36′ S., of 59.9°; though in some instances it has been found several degrees more or less at the same season, and under nearly the same latitude. The chief cause of the variation is the perpetual flow of water from the poles to the equator, which has been already explained. It has been pretty nearly ascertained, that, in the tropical seas, it ranges about 9° of Fahrenheit; in the middle of the temperate zone about 12°; and after that decreases with a more rapid and more equable gradation. The temperature of the sea is also affected by its depth. In deep seas, between the tropics, the heat diminishes towards the bottom; while, in more frigid latitudes, it is sometimes observed to become warmer. The sea is a bad conductor of heat; the solar rays can only penetrate about three hundred feet below the surface, nor does the light descend any farther. A small difference is discovered between the observations on temperature in the two hemispheres. For the first 25° towards the

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south, the decrease of heat is slower, and after that more rapid, than towards the north.

It must be evident to every one who considers the great mass of waters composing the ocean, and the interchange of position which must always be taking place, to a greater or less extent, between the upper and warmer parts and the lower and colder, that this comparative equability of temperature is unavoidable, even if there were no other causes to account for it. The uses of that equability are still more obvious, and must add greatly to the wonder we always experience when the economy of nature is minutely traced. By this equability, the natural result of high latitude is more or less corrected, for the advantage of the human beings who happen to be placed there. A milder air breathing from the sea softens the climate all over the adjacent land, and produces a freshness which is of the greatest service to vegetation. On the other hand, in those torrid regions where both animated and vegetable nature is apt to sink beneath the vertical rays of the sun, the cooling breath of the ocean comes, generally at fixed times, reviving the parched soil, and communicating to man sensations of relief and pleasure, which are hardly to be imagined by those who have not experienced them.

Saline Property of the Sea. — The saline property of the sea has never been scientifically accounted for. Some have alleged that it is caused by fossil or rock salt at the bottom, while others maintain that the sea is a homogeneous salt body, that its waters were created, and have continued, and ever will continue, in this saline condition, in the same manner that the atmosphere has been created and exists as a compound body.

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The proportion which the saline matters bear to the water varies considerably. The water of the Atlantic Ocean, within the tropics, contains about one twenty-fourth of its weight of saline matters. There, from the great heat, very great evaporation must go on at the surface; and from the great mass of water, particularly far out at sea, the influence of rivers in counteracting the effect of the evaporation, by adding, fresh water, must be less than usual. In the Frith of Forth, the saline matters form only one thirtieth of the weight of the water. There, less fresh water is removed by evaporation, the climate being much colder; and the fresh water supplied by rivers is greater in proportion, so that the salt matter bears a smaller proportion to the whole. There are chiefly four matters contained in sea-water, — common salt (muriate of soda), glauber salt (sulphate of soda), muriate of magnesia, and muriate of lime. Potash has been detected in sea-water; and it also contains extremely small quantities of two simple substances lately discovered, namely, iodine and bromine, in union with hydrogen. Disregarding all except the four first, the composition of the water of the Atlantic Ocean, as analyzed by Dr. Marcet, may be stated as follows. The quantity examined was 500 grains.

Water	478.420
Muriate of soda . . .	13.3
Sulphate of soda . . .	2.33
Muriate of lime . . .	0.995
Muriate of magnesia . .	4.955
	500 grains.

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Thus it is seen that muriate of soda, or common salt, is the principal solid ingredient in the waters of the ocean, and that muriate of magnesia is the next in importance. Sea-water is to a certain degree more dense, or of greater specific gravity, than pure water. According to Dr. Arnot, "a ship draws less water, or swims lighter, by one thirty-fifth, in the dense, salt water of the sea, than in the fresh water of a river; and for the same reason, a man swimming supports himself more easily in the sea than in a river." Sea-water freezes at 28° of Fahrenheit's thermometer. Fresh water, as is well known, expands equally in its volume, 8° above or below 40°, that is to say, it expands by an increase of temperature up to 48°, or by a diminution of temperature down to 32°, the common freezing point, when it assumes the crystallized or icy form. Thus 40° is the point of mean density, or of smallest volume, in fresh water. By the recent experiments of chemists, it is found that sea-water does not expand by a diminution of temperature down to 32°, because it is reluctant to assume the crystallized form, and when it does freeze at 28°, its ice is very imperfect, being full of pores and interstices, and composed in a great degree of thin spicular flakes, inclosing drops of a strong briny liquid which cannot be crystallized.

Sea-water, on being boiled, or exposed in small quantities to the sun's rays, evaporates, and leaves a residuum of common salt; and the manufacture of this article, by means of pans and furnaces, is carried on upon the shores of almost every civilized country. Innumerable have been the attempts to render sea-

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water useful as an element of food or drink, in cases of great scarcity of fresh water on shipboard, but in no case has a perfectly pure or sweet water been procured. Filtration has no effect, because the saline matters in the water are chemically united with it, and cannot be removed by means merely mechanical. The process of purifying the water to the best advantage consists in distilling it, the vapor being gathered and condensed into a liquid. But this liquid is not entirely fresh or sweet, in consequence of its containing certain gaseous matters; and, therefore, after distillation, the liquid should for a length of time be exposed to the action of the atmosphere, so as to allow the escape as far as possible of the gases with which it is charged. A small quantity of potash or soap put into the water previous to distillation, is said to be useful in purifying it, and rendering it more palatable.

The following plan for procuring fresh water at sea, in a case of emergency, was pursued by a Captain Chapman, when sailing off the north coast of Finland. By accident he lost nearly all his water; and while thus circumstanced, a gale of wind arose, which blew hard for three weeks, and drove him far out to sea. The captain was in great anxiety. The water in the ship would last but a short time, and he had no still on board. But necessity, the mother of invention, aided him in contriving one. By means of an old pitch-pot, with a wooden cover, and a pipe made of a pewter plate, and a cask for a receiver, he commenced operations. He put seven quarts of sea-water and an ounce of soap into the pot, and placed it on the fire. As soon as the pot boiled, the condensed vapor began

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to flow through the pipe into the receiver. In half an hour he obtained a quart of fresh water. This water, though not very palatable, answered for all necessary puposes. They kept their still constantly at work, and got a gallon of water every two hours; and thus the crew were saved from great suffering, if not from actual death.

PHOSPHORESCENCE OF THE SEA. — Every one who has been at sea, and observed the action of the waters at night, must have occasionally, remarked certain luminous appearances in the waves. Accounts of the phosphorescence of the sea may be found in the narrative of almost every voyager. The following description is given by Mr. Stewart, in his "Journal of a Residence in the Sandwich Islands": — "The exhibitions of the day have been followed at night by a phosphoretic scene of unrivalled splendor and sublimity. We had often before observed luminous points, like sparks of fire, floating here and there in the furrow of our vessel, but now the whole ocean was literally bespangled with them. Notwithstanding the smoothness of the surface, there is a considerable swell of the sea; and sparkling as it did on every part as with fire, the mighty heavings of its bosom were indescribably magnificent. It seemed as if the sky had fallen to a level with the ship, and all its stars, in tenfold numbers and brilliancy, were rolling about with the undulations of the billows.

"The horizon in every direction presented a line of uninterrupted light, while the wide space intervening was one extent of apparent fire. The sides of our vessel appeared kindling to a blaze, and, as our bows

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occasionally dashed against a wave, the flash of the concussion gleamed half way up the rigging, and illuminated every object along the whole length of the ship. By throwing any article overboard, a display of light and colors took place surpassing in brilliancy and beauty the finest exhibition of fire-works. A charming effect was produced by a line coiled to some length, and then cast into the water at a distance, and also by a bucket of water dashed from the side of a vessel. The rudder, too, by its motions, created splendid coruscations at the stern, and a flood of light, by which our track was marked far behind us. The smaller fish were distinctly traceable by running lines showing their rapid course, while now and then broad gleamings, extending many yards in every direction, made known the movements of some monster of the deep. But minuteness will only weary, without conveying any adequate impression of the scene; it would have been wise, perhaps, only to have said that it was among the most sublime nature herself ever presents.

"The cause of this phenomenon was long a subject of speculation among men of science, but is now satisfactorily ascertained to be sea-animalculæ of the luminous tribe, particularly the species *Medusa*. The *Medusa pelucens* of Sir Joseph Banks, and the *Medusa scintillans* of Mr. Macartney, emit the most splendid light. The degree and brilliancy of the exhibition are supposed to depend on the state of the atmosphere and sea. A more grand display than that which we have witnessed probably seldom, if ever, takes place."

This phenomenon has been ascribed to various causes, but the explanation presented by Mr Stewart is the

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one now most generally admitted. The little animal by which this light is produced is sometimes called *the glow-worm of the sea.* It is exceedingly small, thin, and transparent, and, like the fire-fly, with which we are all acquainted, emits a brilliant light. The sea contains many animals of this nature, of different species. The *Medusas* have little antennæ or horns, from which they dart a strong light, while the rest of their body remains in obscurity. All the zoöphytes appear to be in a greater or less degree phosphorescent.

Some accurate observers have also thought, that in addition to this *glow-worm* light, there is a luminous appearance originating from the decomposition of vegetable and animal substances, similar to the phosphorescence of rotten wood.

THE COLOR OF THE OCEAN. — The water of the sea is colorless when examined in small quantities, but when viewed in the mass in the wide ocean, it appears to be of an azure or blue tint. The cause of this generally blue color of the deep sea has not been as yet clearly explained; but it seems to be in some degree accounted for by reference to certain principles connected with the science of optics. Probably most are aware that light consists of the set of colors which we see so beautifully displayed in the rainbow. Now, it is a law of light, that, when it enters any body, and is either reflected or transmitted to the eye, a certain portion of it, consisting of more or less of its colors, is lost in the body. The remainder, being reflected, strikes our visual sense, and, whatever color that may be, the object seems of that color. Now, it chances that the portion of light most apt to be reflected from masses

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of transparent fluid is the blue; and hence it is, or supposed to be, that the air and sea both appear of this color.

While there can be no doubt that the ocean is generally of a blue color, it is equally certain that there are many portions of sea in which a different hue appears. The causes of these exceptions from the rule seem to be of various kinds. Frequently, the ordinary color of the sea is affected by the admixture of foreign substances, these being sometimes of a living and organic nature, and sometimes the reverse. The most simple example of the latter class of cases is the common flooding of any stream, when quantities of mud and earthy particles are introduced into the river, and emptied into the sea. What is thus strikingly seen on every coast, on a small scale, will readily be conceived to be of infinitely wider extent in the mighty rivers of the principal continents of the globe.

Thus is it with the great streams of South America, where the Plata forms a sloping bank which extends a hundred miles into the Atlantic, and still more conspicuously in the mighty Amazon, with a course of 3,000 miles and a breadth at the mouth of 150 miles. Its immense body of water often rushes with a dreadful impetus and velocity into the ocean, freshening its waters to the distance of 250 miles from shore. Hence, then, in such circumstances, the mariner, when still far from land, is not surprised when he ploughs an ocean quite of a *brownish hue.*

It is from the same cause that the well known *Yellow Sea* acquires its appearance and appropriate name. Mr. Barrow estimates the quantity of yellow-colored mud

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which is transmitted by the Hoang-ho or Yellow River, whose course is 2,000 miles, at 2,000,000 of solid feet an hour, or 48,000,000 a day, or 17,580,000,000 a year. "Supposing," he adds, "the mean depth of the Yellow Sea to be 120 feet, the quantity of earth brought down would, if accumulated together, be sufficient to fill up to the surface of the sea an island of the extent of a mile square every seventy days." The testimony of Captain Basil Hall is quite satisfactory as to the result of all this. "The water of the Yellow Sea, over which we were sailing, was contaminated by the intermixture of mud slightly yellow in its color. We sailed on directly across this sea for two whole days without seeing land, and gradually diminishing the depth of water, till at last we began to have some apprehension that we should fairly stick in the mud. It was soon afterwards discovered that the brig was actually sailing along with her keel in the mud, which was sufficiently indicated by a long yellow train in our wake. Some inconvenience was caused by this extreme shallowness, but there was not in reality much danger, as it was ascertained, by forcing long poles into the ground, that for many fathoms under the surface on which the sounding-lead rested, the bottom consisted of nothing but mud formed of an impalpable powder, without the least particle of sand or gravel."

Still more striking results arise from living vegetables and animals. The influence of vegetables in coloring large masses of water may be illustrated by a reference to the Lake of Geneva and the Red Sea. The waters of the Lake usually are of a fixed pale blue color, the delicate beauty of which arrests

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the admiration of every traveller. But while such is the proper color of these waters, occasionally, though rarely, they are as decidedly of a green hue; and we have it upon the authority of Sir Humphrey Davy, that on these occasions the change of color is produced by the water being impregnated with vegetable substances. And respecting the Red Sea, let us hear the testimony of the eminent naturalist Ehrenberg. "I was for many months at Tor, on the Red Sea, near Mount Sinai. I there observed the striking phenomenon of the whole bay being of a bloody color; the main sea, beyond the coral reef, was as usual colorless. The short waves of the calm sea carried to the shore a blood-colored shining mass, which it deposited on the sands, so that the whole bay, fully half a league in length, at the ebb of the tide, exhibited a blood-red border more than a foot wide. This appearance was not permanent, but periodical. It attracted my attention as explanatory of the name of the Red Sea, a name hitherto of difficult explanation. Upon examination, this color was found to be produced by one of the algæ, a marine vegetable."

The extraordinary part which animals play in coloring the ocean, may be demonstrated by alluding to the vast tracts of the Northern Sea, which among mariners are familiarly known as *green water*, and which do not, under any circumstances, assume a blue tint. Mr. Scoresby thus describes them:—"After a long run through waters of the common blue color, the sea became green and less transparent. The color was nearly grass-green, with a shade of black. Sometimes the transition between the green and blue water is pro-

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gressive, passing through the intermediate shades in the space of ten or twelve miles; at others, it is so sudden that the line of separation is seen like the ripple of a current, and the two qualities of water keep apparently as distinct as the waters of a large muddy river on first entering the sea. In 1817, I fell in with such narrow stripes of various-colored water, that we passed streams of pale green, olive-green, and transparent blue, in the course of ten minutes sailing." These green regions extend for tens of thousands of miles, and it has been distinctly proved that the peculiar color is produced by inconceivable multitudes of microscopic animals, principally minute sea-blubber, *medusæ*, and *infusoriæ*. Some of these animals are green, and directly produce the color which is exhibited, but many more are yellow, which color, combining with the blue of the sea-water, will also, as every one knows, produce a green tint.

Other appearances, proceeding from a similar cause, and, if possible, still more striking, are also witnessed. Thus, a red color, sometimes characterized as blood or carmine red, frequently astonishes the voyager. The water of the Gulf of California in the Northern Pacific is reddish, whence it is sometimes named the Vermilion Sea. Captain Colnet, in the interesting account of his voyage, states, "That the set of the currents on the coast of Chili may at all times be discovered by noticing the direction of the beds of small blubber with which the coast abounds, and from which the water derives a color like that of blood. I have often been engaged," he adds, "for a whole day in passing through various sets of them."

The celebrated naturalist, D'Orbigny, makes similar

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remarks concerning the waters of the Atlantic. "There are immense tracts," says he, "off the coast of Brazil, filled with small animals so numerous as to impart a red color to the sea; large portions are thus highly colored, and receive from the sailors the name of the Brazil Bank. This bank extends over a great part of the coast of that country, keeping at nearly the same distance from the shore. Another bank of the same sort occurs near Cape Horn, in Lat. 57° S."

Captain Cook, in his third voyage, encountered the same appearances, and states, "That on examination the phenomenon was found to proceed from an infinity of little animals, which, when viewed by the microscope, had the shape of cray-fish of a red color." Hence we are not to wonder, that, according to an intelligent mariner, "The southern seas sometimes presented an appearance which terrified their early navigators, who, seeing large spaces of the sea of a blood-red color, conceived it a portent of some dreadful catastrophe." These singular appearances are not, however, confined to southern regions. At all events, Mr. Scoresby narrates, that he noticed in his last voyage, in 1823, some insulated patches of reddish-brown water, which were found to be occasioned by animalculæ; and often, too, were the icebergs and snows tipped with an orange-yellow stain. "The animal," he adds, "which gives this peculiar color to the sea, is about the size of a pin's head, transparent, and marked with twelve distinct patches of a brownish color." The same appearances have not unfrequently been noticed in fresh water; and, under the name of *blood-rain*, have sometimes caused no small alarm over wide districts.

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We cannot attempt to account for all these appearances, but may remark that M. Ehrenberg, in the steppes of Siberia, examined some of these waters. "In a fen," he remarks, "with a pool of water, the dark red blood-color was very striking, even at a distance. This color I found on examination was confined to the slimy surface, which in different places formed a shining skin. The red color was darkest up the edge of the marsh. M. Chantran, in the year 1797, examined in France a pond which exhibited the same appearances, the water being of a brilliant red color, with a shade between cinnabar and carmine; as did Weber in Germany, near Halle, in 1790. In all these latter instances, the color was produced by infusory animals. Milk-white is another color which is not unfrequently mentioned. Thus Captain Tuckey states, that, near Cape Palmas, upon the coast of Guinea, his vessel appeared to move in milk, which circumstance arose from the multitude of animals upon the surface, which obscured the natural color of the liquid. And, once more, the existence of a yellow-colored sea from the same cause is satisfactorily established. "In approaching the south point of America," says Captain Colnet, "we this forenoon passed several fields of spawn, which caused the water to bear the appearance of barley, covering the surface of a bank."

These causes of varied color in the ocean, however striking in themselves, are not likely to mislead any one as to the inherent color of its waters. It is different, however, with the class of causes to which we now proceed, and which we may arrange under the head of the reflection of colored rays from the bed or bottom of

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the sea. Sometimes, indeed, though rarely, these appearances are quite as singular as any we have hitherto considered. Thus, in the Bay of Loango, the waters are almost always of a deep red color; so much so, that they are said to be mixed with blood, and Captain Tuckey satisfied himself that the bottom is intensely red. Let us substitute for this bright red bottom one of the same shade, but obscure and slightly reflecting, and the water of the Bay of Loango would then appear of an orange-yellow color. Far more frequently, however, the bed of the sea is of a yellow rather than a red hue; and if this color is at all bright and strong, the slight blue of the pure water will scarcely affect it, and then the waters will appear yellow, — a tint which, let it be observed, is in fact by no means uncommon on many sea-shores. But bright yellow is by no means so common a tint of sea-sand as is dull or obscure yellow; and this, owing both to its own proper color, and also to its being obscured by a great mass of superimposed water. When the yellow hue is thus reduced, the feeble ray reflected from the bottom, mixing with the pale blue of the ocean, produces, as is universally known, a green tint, which is communicated to the water; and this is one of the most widely spread modifying causes of change in the proper color of the sea.

But the most difficult part of the problem still remains; and that is, to account for the green color of the ocean in those places where it is hundreds and thousands of fathoms deep, and where, of course, every thing like reflection from the bottom is quite out of the question. M. Arago, to account for the phenomena occuring under such circumstances, offers a theory

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which resolves itself into the principle, that when the surface is troubled, the luminous rays, coming from the waves to the eye, consist more of transmitted rays than of reflected rays, and therefore are green. According to this view, the appearances exhibit themselves only during a breeze which disturbs the surface, and in the midst of a swell, so common over the ocean. The observer stands upon the deck of the vessel, the billows often overtopping the level of the ship; the luminous rays which reach the eye from the sea must have passed from the distant horizon through one or more of the watery ridges; thus the transmitted rays have predominated over the reflected ones, and so, according to the allowed fact, must be green.

WINDS. — A change in the temperature, a diminution of the vapor, or any other cause that may occasion a portion of the surrounding atmosphere to contract or expand, will give rise to the aerial currents denominated winds, which, indeed, bear a strong analogy to the currents which occur in the ocean. When the air by which we are surrounded becomes heated, it expands, and becomes specifically lighter, in consequence of which it mounts upward; and the colder and denser air which surrounds the mass thus rarefied rushes in to supply its place. When the door of a heated apartment is thrown open, a current of air is thereby immediately produced; the warm air from the apartment passing out, and the cold air from the passage rushing in. So, also, in those buildings where the manufacture of glass is carried on, the heat of the furnace in the centre being intense, a violent current of air may be observed to force its way

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in through the doors or crevices on the opposite sides of the house.

On applying these principles to account for the origin of the wind, we find, that when the rays from the sun, by their reflection from the earth's surface, have heated or rarefied a portion of the surrounding air, the air so rarefied ascends into the higher regions of the atmosphere, and the colder air by which it was surrounded moves forward in a sensible current to fill the vacuity. When, also, a condensation of vapor in the atmosphere suddenly takes place, giving rise to clouds which speedily dissolve in rain, the temperature of the surrounding air is sensibly altered, and the colder, rushing in upon the warmer, gives rise to a sudden gust of wind. For this reason, a cold, heavy shower passing over head, with a hasty fall of snow or hail, is often attended with a violent and sudden gust of wind, which ceases when the cloud disappears, but is renewed when another cloud, sweeping along in the same direction, brings with it a fresh blast. Accordingly, a whistling, or howling, or noise of the wind, is universally considered to be a prognostic of rain, because it indicates that a change is taking place in the temperature of the atmosphere, owing to the vapor in its higher regions being condensed into rain-clouds.

The most remarkable winds are those which traverse the ocean steadily in one direction, and are called *trade-winds* from their use in mercantile navigation. In order that we may distinctly understand the cause and nature of the trade-winds, it is necessary to bear in mind that the earth in the centre

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of its circumference, at an equal distance from the poles, is divided by a line called the equator into two hemispheres, the Northern and the Southern. By seamen this equator is called *the line;* and when they sail over it, they are said to *cross the line.* Across the equator, cutting it obliquely, there passes another great circle called the ecliptic, which describes the path the sun traverses. It extends 23½° north and 23½° south of the equator, which is the utmost limit the sun traverses; for when arrived at either of these boundaries, he again seems to return towards the equator. It must be very evident that the region of the earth included within a circle drawn 23½° north and 23½° south of the equator, — which will comprehend the greatest portion of Africa, a considerable part of Asia and America, and many large, fertile, and populous islands in the East and West Indies, — will receive constantly the solar rays in a direction so little oblique, that the most intolerable heat might there be anticipated. It was therefore called the torrid zone; and the limits at which the sun stops, and appears to retrace his course, have received the name of tropics, or *circles of return.*

This being premised, and it being also remembered that the earth revolves daily round the sun from west to east, the cause of the trade-winds will be readily understood. The rays of the sun, in its apparent motion from east to west, obviously rarefy, by the heat they impart, the air beneath, and the air so rarefied rises into the higher regions of the atmosphere. While this takes place, the colder air from the adjoining temperate zones rushes in to supply its place. But it is from the

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polar regions, north and south, that these colder currents originally come; and did the earth remain at rest, such would be their obvious direction. Instead of this, however, north of the equator the direction of the trade-winds is from the northeast; south of the equator, from the southeast; the cause of which is thus explained. The velocity with which the earth revolves is inconsiderable, if at all appreciable, at the poles, but increases as we advance, and is at its maximum at the equator; the winds, in sweeping from the poles, do not acquire a corresponding velocity with the motion of the earth as they advance towards the equator; therefore, moving more slowly than the earth, they are left behind, striking bodies with the excess of the earth's velocity; so that, to the observer who imagines himself at rest, the air appears to move in a direction contrary to the rotation of the earth, namely, from east to west. While the trade-wind thus blows upon the surface of the earth, there is no doubt that an opposite current, probably that of the rarefied air which has ascended, flows in the contrary direction at a great elevation in the atmosphere.

The external limits of the trade-winds are 30° north and 30° south of the equator; but each limit diminishes as the sun advances to the opposite tropic. The larger the expanse of ocean over which they sweep, the more steadily do they blow; accordingly, they are more steady in the Pacific than in the Atlantic, and in the South than in the North Atlantic Ocean. Within the region of the constant trade-winds, rain seldom occurs, but it falls abundantly in the adjoining latitudes. The reason is, that rain is produced by the sud-

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den mixture of air of different temperatures charged with moisture; but the constant circulation and intermixture of the air from the upper strata of the atmosphere, or ground current, maintains so equal a temperature in these latitudes as not to occasion the condensation of vapor which is necessary for the production of rain. Besides which, it is plausibly enough alleged by Daniel, that the aqueous vapor constantly flows off in the current of the equatorial wind into the adjoining temperate zones. Within the limits of the trade-winds, contrary to what might have been anticipated from the latitude, the atmosphere is peculiarly cool and refreshing.

Sea and Land Breezes. — In most countries near the shores of the sea, but particularly in tropical climates, there are periodical winds called sea and land breezes; they occur in the following manner. During the day, the wind blows for a certain number of hours from the sea to the land; but when the evening arrives, it changes its direction, and blows as many hours from the land to the sea. In some countries the sea-breeze sets in about seven or eight in the morning, and is strongest at noon, but continues very sensible until three o'clock, when the surface of the sea will be observed to exhibit ripples of a deep blue color. After this, at six in the evening, the land breeze commences. The sea now assumes a greenish hue; and this breeze continues until eight the next morning. The cause of this alternation may be readily explained. During the day, the air over the surface of the earth is more heated by the rays of the sun than that over the surface of the sea; because the earth,

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from its greater density, comparative state of rest, and numerous elevations, reflects the sun's rays sooner, and with more power, than they are reflected from the sea, which, from its state of constant motion and transparency, imbibes the warmth very intimately, though more slowly.

Accordingly, when the sun, having risen above the horizon, has, by the reflection of its rays, thus imparted a sufficient degree of warmth to rarefy the body of air over the land, the air so rarefied ascends into the higher regions of the atmosphere, while that over the surface of the sea, being scarcely at all rarefied, rushes in to supply its place. Hence, a sea-breeze, or current of air from the sea to the land, at this time prevails; but when the sun again begins to sink below the horizon, the body of air over the surface of the land becomes rapidly cold, and the earth itself, by radiation, parts very quickly with the warmth it had absorbed. Then the land air, being below the temperature of the sea air, rushes in to supply its place, and thus during the night, a land-breeze, or a current of air from the land to the sea, is produced. When the sea-breeze first sets in, it commences very near the shore, and gradually extends itself farther out at sea, and, as the day advances, becomes more or less hot. Hence, the sails of ships have been observed quite becalmed six or eight miles out at sea, while at the same time a fresh sea-breeze has been blowing upon the shore.

The cause of this is obvious; for it is natural to suppose that the mass of air nearest the land will be the first to rush in, for the purpose of supplying the place of the air which is rarefied immediately above it.

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On this account, the effect of the sea-breeze is said not to be perceptible at a distance of more than five or six leagues from the shore, and for the most part becomes fainter in proportion to its distance from land. The distance, on the other hand, to which the land-breeze extends in blowing across the sea depends on the more or less exposed aspect of the coast from which it proceeds. In some places this breeze was found by Dampier brisk three or four leagues off shore; in other places not so many miles; in others, again, it scarcely extended without the rocks. The sea-breeze, from blowing over a more open tract, is always stronger than the land-breeze; but it is observed that the land-breeze is much colder than the sea-breeze. Furthermore, it has been noticed that the tendency of the land-breeze at night has almost invariably a correspondence with the sea-breeze of the preceding or following day. "Should the land-wind from being east, draw, in the course of the night, towards the north, it would be looked upon," says Marsden, in his "History of Sumatra," "as an infallible prognostic of a west and northwest wind the next day; and on this principle it is that the natives foretell the direction of the wind, by the noise of the surf at night, which, if heard from the northward, is esteemed the forerunner of a northerly wind, and *vice versâ*.

"The quarter from which the noise is heard depends on the course of the land-wind, which brings the sound with it, and drowns it to leeward; the land-wind has a correspondence with the next day's sea-wind, and thus the divination is accounted for." Unless for the periodical refreshing, cool breezes from the sea,

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the West India Islands, and generally all hot countries, would scarcely be habitable for the white races of men.

HURRICANES. — The most dangerous winds to the navigator are those which occur in sudden gusts, or squalls, and for the approach of which the sharpest outlook is required. When the squall is in the form of a violent tempest, accompanied by rain, lightning, and thunder, it receives the name of a hurricane. Hurricanes occur most frequently and with the greatest violence in tropical climates, because, in consequence of the very great heat which there prevails, the rarefaction of the air, and also the condensation of the vapor it contains into rain-drops, takes place more suddenly and completely than in more temperate regions. By this means the electricity of the atmosphere, — that subtle fluid which seems to pervade all bodies, and which universally seeks its own equilibrium, — is disturbed, and no longer maintains an equal distribution through the aerial vapor. It accumulates in vast quantities in one mass of vapor or cloud, while in another it is deficient; and, consequently, to regain its equilibrium, it flashes in the form of lightning from the surcharged cloud to the cloud that is undercharged, or to the earth itself. Hence, hurricanes are always attended with electrical manifestations, which add greatly to the tragical horrors of the spectacle they exhibit.

In describing the tremendous hurricane which took place in the West Indies in 1772, a writer observes; — "I must still mention how dreadful every thing looked in this horrible and dark night, there being so many fiery meteors in the air, which I and others who were in the same situation were spectators of. Towards

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the east, the face of the heavens presented to our view a number of fiery rods, — electrical brushes, — which were through the whole night shooting and darting in all directions; likewise fiery balls, which flew up and down, here and there, and burst into a number of small pieces, which, like torches of flaming straw, came very near the road where we lay; yet, notwithstanding all these phenomena, thunder and lightning were abundantly great."

Hurricanes commence in various ways: sometimes from a single and small cloud, which suddenly expands, overspreading, as with a dense shroud, the whole heavens; and sometimes from a slowly gathering mass of clouds which appear to be irradiated with electric fire. When the enterprising navigator, Columbus, was about to depart from Isabella Island, while his vessels were still in the harbour, one of these dreadful hurricanes arose. "About mid-day," says Washington Irving, "a furious wind sprang up from the east, driving before it dense volumes of cloud and vapor. Encountering another tempest from the west, it appeared as if a violent conflict ensued. The clouds were rent by incessant flashes, or rather streams, of lightning. At one time they were piled up high in the sky, at another they descended to the earth, filling the air with a baleful darkness more impenetrable than the obscurity of midnight. Wherever the hurricane passed, whole tracts of forests were shivered and stripped of their leaves and branches, and those of gigantic size, which resisted the blast, were torn up by the roots, and hurled to a great distance. Groves were torn from the mountain precipices, and vast

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masses of earth and rock precipitated into the valleys with terrific noise, choking the course of the rivers. The fearful sounds in the air and on the earth, — the pealing thunder, — the vivid lightning, — the howling of the wind, — the crash of falling trees and rocks, — filled every one with affright, and many thought that the end of the world was at hand. Some fled to caverns for safety, for their frail houses were blown down, and the air was filled with the trunks and branches of trees, and even with fragments of rocks, carried along by the fury of the tempest. When the hurricane reached the harbour, it whirled the ships round as they lay at anchor, snapped their cables, and sunk three of them to the bottom, with all who were on board. Others were driven about, dashed against each other, and tossed, mere wrecks, upon the shore by the swelling surges of the sea, which in some places rolled for three or four miles upon the land. The tempest lasted for three hours. When it had passed away, and the sun again appeared, the Indians regarded each other with mute dismay. Never, in their memory, nor in their traditions, had their island been visited by such a tremendous storm. They believed that the Deity had sent this fearful ruin to punish the cruelties and crimes of the white men, and declared that this people had moved the very air, the water, and the earth, to disturb their tranquil life, and to desolate their island."

The West Indies, the Isle of France, and the empires of Siam and China, are the countries which are most subjected to the ravages of hurricanes. In the West Indies they most frequently occur in the month of August, and the Indians, from their experience, origi-

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nally taught our planters the signs by which their approach may be prognosticated. The hurricane occurs either in the first quarter or at the full change of the moon. If it come on at the full, then at the preceding change the sky looks troubled, and the sun more red than usual; besides which, there is a dead calm below, and the mountain tops are free from those mists which usually overhang them. In the caverns of the earth, and in wells, a hollow, rumbling noise, like a rushing wind, is heard, and animals are observed to tremble and be much disturbed. Many animals, indeed, appear to be very sensible of any change in the electrical state of the atmosphere, and indicate their uneasiness by moaning and great restlessness. At night the stars seem larger than usual, and are frequently surrounded with halos. It is said, also, that the sea emits a strong smell, and rises into vast waves, without any wind being perceived. When the wind rises, it shifts from its common easterly direction to the west, whence, with occasional intermissions, it blows irregularly and violently. The moon, likewise, is frequently surrounded by a halo, and many luminous meteors appear in the heavens. Notwithstanding that by observation we may thus predicate the approach of hurricanes, it does not appear that we are at present able to avert them by any contrivance of art. The careful and skilful mariner, as his only safeguard, trusts to the trimming of his vessel to meet the expected tempest.

Calms and Breezes. — "After a storm comes a calm," is an old proverb. The fury of the tempest expends itself, and in all likelihood there shortly after ensues a state of tranquillity, though several days may

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elapse before the "swell," or heaving agitation of the sea, subsides. When both the atmosphere and the waters are tranquil, the surface of the ocean is beautifully calm, and almost as smooth as the glassy surface of a lake. But a perfect or dead calm, if of any continuance, is almost as disagreeable to the navigator as a driving tempest. The ship makes no progress in its course; its sails are useless; and there are no means of removing from the dull and distressing scene. This condition of things is well described by the poet.

"Down dropped the breeze, the sails dropped down,
'T was sad as sad could be,
And we did speak only to break
The silence of the sea!

"All in a hot and copper sky,
The bloody sun at noon,
Right up above the mast did stand
No bigger than the moon.

"Day after day, day after day,
We stuck, nor breath nor motion;
As idle as a painted ship
Upon a painted ocean.

"Water, water everywhere,
And all the boards did shrink;
Water, water everywhere,
But not a drop to drink."

Fortunately, dead calms are not generally of that continuance which leads to any serious result. A gentle breeze begins to steal upon the face of the deep, and the hitherto unruffled surface of the waters shows a slight, tremulous ruffling, technically called the *crow's foot*. Sailors have a superstitious belief, that whistling

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in a calm will bring up a breeze, and this they do with a drawling and beseeching intonation on some prominent part of the vessel. Captain Hall gives a description of the rise of a breeze, in connection with these whistling efforts of the sailors, on board a ship.

"In the course of the afternoon, we perceived from the mast-head, far astern, a dark line along the horizon, which some of our most experienced hands pronounced the first trace of a breeze coming up. In the course of half an hour, this line had widened so much that it could easily be perceived from the deck. Upon seeing this, the whistlers redoubled their efforts; and whether, as they pretended, it was owing to their interest with the clerk of the weather-office, or whether the wind, if left alone, would have come just as soon, I do not venture to pronounce; but certain it is, that, long before sunset, our hearts were rejoiced by the sight of those numerous flying patches of wind, scattered over the calm surface of the sea, and called by seamen *cat's-paws*, — I presume from the stealthy, timorous manner in which they seem to touch the water, and straightway vanish again. By and by, the true wind, the ripple from which had marked the horizon astern of us, and broken the face of the mirror shining brightly everywhere else, indicated its approach, by fanning out the sky-sails and other flying kites, generally supposed to be superfluous, but which upon such occasions as this do good service, by catching the first breath of air, that seems always to float above the water. One by one the sails were filled; and, as the ship gathered way, every person marked the glistening eye of the helmsman, when he felt the spokes of the wheel pressing against

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his hand, by the action of the water upon the rudder."

THE POLAR SEAS. — The seas within the Arctic and Antarctic circles exhibit appearances so very remarkable, in consequence of the intense cold which there prevails, that they deserve a particular description. The following vivid sketch of scenes observed within the Arctic seas will be read with interest: —

"After the continued action of the sun has at last melted away the great body of ice, a short and dubious interval of warmth occurs. In the space of a few weeks, only visited by slanting and enfeebled rays, frost again resumes his tremendous sway. It begins to snow in August, and the snow falls to the depth of two or three feet before October. Along the shores and bays, the fresh water, poured from rivulets or drained from the thawing of former collections of snow, becomes quickly converted into solid ice. As the cold augments, the air deposits its moisture, in the form of a fog, which freezes into a fine, gossamer netting, or slender icicles, dispersed through the atmosphere, and so extremely minute, that they seem to pierce and excoriate the skin. The hoar-frost settles profusely, in fantastic clusters, on every prominence. The whole surface of the sea steams like a lime-kiln, — an appearance called the *frost-smoke*, caused, as in other instances of the production of vapors, by the waters being still relatively warmer than the incumbent air.

At length the dispersion of the mist, and the consequent clearness of the atmosphere, announce that the upper stratum of the sea itself has become cooled to the same standard; a sheet of ice spreads quickly over

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the smooth expanse, and often gains the thickness of an inch in a single night. The darkness of a prolonged winter now broods inpenetrably over the frozen continent, unless the moon chance at times to obtrude her faint rays, which only discover the horrors and wide desolation of the scene." The wretched settlers, covered with a load of bear-skins, remain crowded and immured in their huts, every chink of which they carefully stop against the piercing external cold, and, cowering about the stove or the lamp, they seek to doze away the tedious night. Their slender stock of provisions, though kept in the same apartment, is often frozen so hard as to require to be cut with a hatchet. The whole of the inside of their hut becomes lined with a thick crust of ice; and if they happen for an instant to open a window, the moisture of the confined air is immediately precipitated in the form of a shower of snow. As the frost continues to penetrate deeper, the rocks are heard at a distance to split with loud explosions. The sleep of death seems to wrap up the scene in utter and oblivious ruin.

At length the sun reappears above the horizon; but his languid beams rather betray the wide waste than brighten the prospect. By degrees, however, the further progress of the frost is checked. In the month of May, the famished inmates venture to leave their huts, in quest of fish on the margin of the sea. As the sun acquires elevation, his power is greatly increased. The snow gradually wastes away, the ice dissolves apace, and vast fragments of it detached from the cliffs and undermined beneath, precipitate themselves on the shores with the noise and crash of thunder. The ocean

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is now unbound, and its icy dome broken up with tremendous rupture. The enormous fields of ice thus set afloat are, by the violence of winds and currents, again dissevered and dispersed. Sometimes impelled in opposite directions, they approach, and strike with a mutual shock, like the crash of worlds, — sufficient, if opposed, to reduce to atoms, in a moment, the proudest monuments of human power. It is impossible to picture a situation more awful than that of the poor crew of a whaler, who see their frail bark thus fatally inclosed, expecting immediate and total destruction. Before the end of June, the shoals of ice in the Arctic seas are commonly divided, scattered, and dissipated. But the atmosphere is then almost continually damp, and loaded with vapor. At this season of the year, a dense fog generally covers the surface of the sea, of a milder temperature, indeed, than the frost-smoke, yet produced by the inversion of the same cause. The lower stratum of air, as it successively touches the colder body of water, becomes chilled, and thence disposed to deposit its moisture. Such thick fogs, with mere gleams of clear weather, infesting the northern seas during the greater part of the summer, render their navigation extremely dangerous. In the course of the month of July, the superficial water is at last brought to an equilibrium of temperature with the air, and the sun now shines out with a bright and dazzling radiance.

There is no region of our globe more full of appalling scenes and exciting dangers. The descriptions given by those who have ventured among the bleak tempests of these northern seas almost cause the blood to chill in our veins. Many a ship has been surrounded by

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vast islands of ice, and the wretched seamen have there found their graves. Who can read without agitation the following graphic sketch: —

"The fields of ice are frequently of immense extent. Cook found a chain of them which joined Eastern Asia to North America. The appearance of these continents and islands of ice surpasses all that imagination can conceive. Here we fancy that we behold mountains of pure crystal, and valleys sown with diamonds. There grayish towers, with their resplendent points, seem to rise above a rampart crowned with ice. The magnifying medium of a hazy atmosphere renders this spectacle still more gigantic. He must have a heart of iron who dare penetrate into these inhospitable seas; for if the navigator has not to fear tempests, which are extremely rare in these latitudes, nor waterspouts and hurricanes, which are there unknown, he will be assailed by other dangers much more capable of appalling the most intrepid minds. Sometimes huge bodies of ice, impelled along by the winds and the currents of the sea, dash against the frail vessel; and there is no rock so dangerous or so difficult to avoid. Sometimes these floating mountains treacherously surround the navigator, and block up every outlet; his ship is arrested in her course, and becomes immovable. In vain does the feeble axe endeavour to break these enormous masses, in vain do the sails invite the winds; the ship, as it were soldered into the ice, and the mariner, cut off from the world of living beings, remain fixed in a solitude of death. How frightful is the situation of those who, thus hemmed in by the ice, have no other resource left than to quit their vessel and walk

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over that consolidated crust of sea, which is every moment cracking and ready to sink under their feet! When almost dead with cold and hunger, they consider themselves fortunate should the floating piece of ice on which they sail cast them upon the shore of Siberia or Nova Zembla. But there is generally very little hope of life for the wretched beings who suffer shipwreck in these dreadful regions. Either the icy waves engulf them, or they are devoured by the tyrant of this dreadful empire, the white bear; or, lastly, the intensity of the cold extinguishes the vital heat, their feet adhere to the ice, their blood no longer circulates in their veins, and the polar night becomes to them a night which is eternal."

A terrific account has been given of a ship once found floating in this ocean surrounded with fields and mountains of ice, and every individual of the ship's company frozen. The intensity of the cold had preserved every body from corruption. It seems that the ship had been caught in the ice, and detained in defiance of every effort to liberate her. All their fuel was soon consumed. Their fire expired. Every soul was stiffened in death. One gentleman was found with his pen in his hand writing to his absent wife.

The origin of the immense ice mountains which northern navigators so frequently meet, is difficult to be ascertained. The ice which obstructs the navigation of the Arctic seas is of two different kinds. One kind is formed by the congelation of salt water. It is fibrous and very porous, and not at all transparent. Sometimes, as far as the eye can reach, a compact, unbroken field extends. Again, the whole ocean seems filled

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with floating fragments, closely jammed together. Again, those fragments are so separated that a ship may work its way along between them. And still again, these fragments, dashed together by the winds, are ground up to minuter fragments, called *mash ice.*

But the ice mountains, or *icebergs*, as they are usually called, are evidently of different origin; they are formed by the congelation of fresh water, and not salt.

From them, ships supply their casks with the purest and softest water. These mountains rise to an immense height, sometimes towering far above the masts of the largest ships. No explanation of the origin of these has appeared more satisfactory than the one we now quote from a writer in the Edinburgh Review.

"In those inhospitable tracts, the snow which annually falls upon the islands or continents, being again dissolved by the progress of the summer's heat, pours forth numerous rills and limpid streams, which collect along the indented shores, and in the deep bays inclosed by precipitous rocks. There this clear and gelid water soon freezes, and every successive year supplies an additional investing crust, till, after the lapse, perhaps, of several centuries, the icy mass rises at last to the size and aspect of a mountain, commensurate with the elevation of the adjoining cliffs. The melting of the snow, which is afterwards deposited on such enormous blocks, likewise contributes to their growth; and, by filling up accidental holes or crevices, it renders the whole structure compact and uniform. Meanwhile, the principle of destruction has already begun its operations. The ceaseless agitation of the sea gradually wears and undermines the base of the icy mountain, till at length,

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by the action of its own accumulated weight, when it has perhaps attained the altitude of one or two thousand feet, it is torn from its frozen chains, and precipitated with a tremendous plunge into the abyss below. The mighty launch now floats like a lofty island on the ocean; till, driven southwards by the winds and currents, it insensibly wastes and dissolves away in the wide Atlantic.

"Such we conceive to be the real origin of the icy mountains or *icebergs*, entirely similar in their formation to the *glaciers* which occur on the flanks of the Alps and Pyrenees. They consist of a clear, compact, and solid ice, which has the fine green tint verging to blue, which ice or water, when very pure, and of sufficient depth, always assumes. From the cavities of these icebergs, the crews of the northern whalers are accustomed, by means of a *hose* or flexible tube of canvass, to fill their casks easily with the purest and softest water. Of the same species of ice, the fragments which are picked up as they float on the surface of the ocean yield the adventurous navigator the most refreshing beverage."

The quantity of ice occasionally met, even by navigators in the middle of the temperate zone, is truly amazing. Not unfrequently do the regular packets from Liverpool to the United States fall in with these huge floating islands, and vessels in the night have been dashed to pieces by driving against them. Harbours in the northern parts of America are frequently filled with ice driven from the Northern Ocean, and forced in by the wind. The storms of the Arctic Sea pile cake upon cake, forcing the ice at times to rise to an enor-

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mous height, and decking the bleak scene with most fantastic forms of beauty, and terrific spectacles of grandeur.

The mountains of hard and perfect ice, it has been shown, are the gradual production of perhaps many centuries. Along the western coast of Greenland, prolonged into Davis's Straits, they form an immense rampart, which presents to the mariner a sublime spectacle, resembling at a distance whole groups of churches, beetling castles, or fleets under full sail. Every year, but especially in hot seasons, they are partially detached from their seats, and whelmed into the deep sea. In Davis's Straits, these icebergs appear most frequent; and about Disco Bay, where the sounding exceeds three hundred fathoms, masses of such enormous dimensions are met with, that the Dutch seamen compare them to cities, and often bestow on them the familiar names of Amsterdam or Haarlem. They are carried towards the Atlantic by the current, which generally flows from the northeast; and after they reach the warmer water of the lower latitudes, they rapidly dissolve, and finally disappear, probably in the space of a few months.

Waves. — The waves of the ocean are various in figure and dimensions, according to the force and direction of the winds, contending currents, and other causes. The common cause of waves is the friction of the wind upon the surface of the water. Little ridges or elevations first appear, which, by continuance of the force, gradually increase, until they become the rolling mountains seen where the winds sweep over a great extent of water. In rounding the Cape

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of Good Hope, waves are met with, or rather swells, so vast, that a few ridges and a few depressions occupy the extent of a mile.

The velocity of waves has relation to their magnitude. The large waves just spoken of proceed at the rate of from thirty to forty miles an hour. It is a vulgar belief that the water itself advances with the speed of the wave, but in fact the *form* only advances, while the *substance*, except a little spray above, remains rising and falling in the same place, with the regularity of a pendulum. A wave of water, in this respect, is exactly imitated by the wave running along a stretched rope when one end is shaken; or by the mimic waves of our theatres, which are generally undulations of long pieces of carpet, moved by attendants. But when a wave reaches a shallow bank or beach, the water becomes really progressive, for then, as it cannot sink directly downwards, it falls over and forwards, seeking the level.

So awful is the spectacle of a storm at sea, that it is generally viewed through a medium which biases the judgment; and, lofty as waves really are, imagination pictures them loftier still. A wave rarely rises more than ten feet above the ordinary sea-level, which, with the ten feet that its surface afterwards descends below this, gives twenty feet for the whole height, from the bottom of any water-valley to an adjoining summit.

MARITIME DISCOVERY. — Navigation is the art of conducting vessels at sea in the direction in which they are designed to proceed; the term is derived from the Latin words *navis*, a ship, and *ago*, to manage or govern. From *navis* also is derived the term *navy*,

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which signifies a collection of ships. The terms *marine*, *maritime*, and *mariner*, are likewise from a Latin root, to wit, *mare*, the sea.

Of the early history of ship architecture and navigation, little can be said of any importance. The buoyant property of water, particularly that of the sea, must have been soon observed by mankind, and therefore, beginning with rude skiffs and canoes, they would in time acquire sufficient experience and skill to construct vessels of a larger size, and to guide them in the required direction by means of a rudder and sails. The cultivated nations of antiquity, Egyptians, Carthaginians, Phœnicians, and others, living on the shores of the Mediterranean, possessed ships both for commerce and war, some of which were of a large size, and moved by rowers, and winds acting on the sails. But no people of antiquity possessed the courage or skill to navigate their vessels out of sight of land, or, at least, to push into the open Atlantic or other great oceans.

Maritime intercourse, for the sake of traffic, was carried on only along the shores of the Mediterranean, or down the Red Sea, and along the coast to India, or along the western shore of Europe to Britain. The Romans thought they performed a wonderfully bold feat when they sailed a ship as far as the northern islands of Scotland. In these times there was no other known guide, with respect to the cardinal points, than the stars by night and the sun by day; and, therefore, when clouds covered the visible horizon, or when total darkness ensued at night, the ship was necessarily brought to a pause, or placed in the most imminent

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danger of being wrecked on some unknown shore. This, however, was not the only difficulty. The nations of antiquity, with all their learning, were utterly ignorant of the form and size of the globe. They believed that the world was a great flat plain, with the habitable earth placed in the midst of the ocean; that this ocean was of interminable breadth; and that, at a certain distance from land, the waters were shrouded in eternal darkness. With such notions prevailing among mankind for thousands of years, it is not surprising that they should have made so slow advances in the art of navigation, or done so little for maritime discovery.

During the Middle Ages, from the fourth to the fourteenth century, ship-building was considerably improved by the Italians, who then conducted a large maritime traffic on the Mediterranean; but the art of navigation, in the proper sense of the term, was still in its infancy, and its history cannot be said to commence till the beginning of the fourteenth century, when that wonderful instrument, the mariner's compass, was discovered, or came first into observation in Europe. Of the polarity of the magnet, or its tendency to point to the poles, it is here only necessary to say how this polarity is rendered subservient to the purposes of the navigator. The mariner's compass, which consists of a magnetized slip of metal, or needle, as it is called, poised on its centre, and free to point to the poles, was first made known, as far as it can be ascertained, by one Flavio Gioja, an Italian, in the year 1302. As with all great discoveries, its advantages were not at once recognized. It had to contend

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against a variety of prejudices; but these in time vanished, and about the middle of the fourteenth century its important uses were allowed and established.

Navigation now assumed a much bolder character than formerly. The English, Portuguese, Italians, and Spaniards pushed their vessels into districts of ocean never previously traversed, and thus the way was fairly opened for maritime discovery. The first great discoverer who made use of the compass, and partly improved its construction, was Prince Henry, a son of the king of Portugal, and who is known in history by the name of Henry the Navigator. This intelligent and enterprising prince (born 1394, died 1361), with the concurrence of the Portuguese government, set on foot a series of maritime enterprises, with the view of discovering a route to India by way of the Atlantic. These voyages ultimately proved successful; the islands of Puerto Santo, Madeira, and the Canaries, were successively discovered, and annexed to the crown of Portugal.

In 1433, the Portuguese navigators penetrated beyond Cape Bojador, on the coast of Africa, which was considered an extraordinary performance; another expedition afterwards went as far as Cape Blanco, and discovered the island of Arguin and the Cape de Verde Isles; and, in 1448, the Azores were reached and made known. Henry the Navigator thus struck a spark which kindled to a flame all over Europe. Not long after his death, the Guinea coast was added to the Portuguese discoveries. In 1484, the Congo was reached by Diego Cam; in 1487, the Cape of Good Hope was doubled by Bartholomew Diaz; and, in 1498, Vasco de Gama touched the shores of Hindostan.

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The Portuguese having received an assignment from the Pope of all lands that could be discovered on the African coasts, the Spanish government, burning with anxiety to emulate the late proceedings of its neighbours, was compelled to seek out new countries in a different direction. Ferdinand and Isabella, the sovereigns of Spain, listened, therefore, to the speculations of Columbus regarding a route to India across the Atlantic, and sent him off on a mission. In his bold attempt to reach Hindostan by pursuing a direction across the Atlantic, he landed on one of the American islands, now called the Bahamas, on the 12th of October, 1492. About the year 1499, Amerigo Vespuccii, under an appointment from the Spanish government, discovered the coast of the South American continent, and hence the name of *America* was given to the New World, although, as is well known, Columbus had previously discovered and landed on South America, without being aware that it was the continent which he had reached.

Several subsequent voyages by Spanish navigators disclosed the extent of the east coast of South America, and, in 1513, Nunez de Balboa crossed the isthmus of Panama with an exploring party of his sailors, and made the discovery of the Pacific Ocean on the west coast of that continent. It was now seen that America was not, as had been at first believed, a portion of Asia or India, but was a separate territory of vast extent lying between the Atlantic and Pacific. There was yet a doubt with respect to the southern extremity of America; but in 1520, Magellan made the passage from the Atlantic to the Pacific by the straits which

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separate America from the island of Terra del Fuego, at about the fifty-third degree of south latitude, and so removed all doubt upon the subject. This navigator extended his voyage across the Pacific to the Philippine Islands, where, unfortunately, he was killed; but his companions proceeded in the route homewards by the Cape of Good Hope, and thus, by circumnavigating the globe, settled the long-disputed problem with respect to the sphericity of our planet. This most important voyage was made between the years 1520 and 1523.

In the mean while, several maritime discoveries were made by the English nation. In 1495, John Cabot, a Venetian pilot, settled at Bristol, obtained from Henry the Seventh letters patent, empowering him and his three sons, Lewis, Sebastian, and Sanctius, to discover unknown lands, and conquer and settle them. In consequence of this permission, the king supplied one ship, and the merchants of London and Bristol a few smaller ones, and in 1496 John and Sebastian sailed to the northwest. In July of the same year, they discovered Newfoundland, and explored it up to Lat. 67° N. In a subsequent voyage, the father and son sailed as far as Cape Florida, and are believed to have been the first who saw the main land of America. By these and succeeding voyages of discovery in the reigns of Henry the Eighth, Edward the Sixth, and Elizabeth, the English became possesssed of the eastern coast of North America, and some of its islands. Between the years 1740 and 1744, Anson was employed in circumnavigating the globe, and visiting different parts of the Pacific; but this extensive and

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protracted voyage added little to the existing knowledge of geography. At a later period, in the reign of George the Third, Cook explored the groups of islands in the Pacific, making various interesting discoveries, in which was included a survey of the eastern coasts of Australia and Van Diemen's Land, and a visit to the New Zealand Islands. After the voyages of this enterprising navigator, little was left to perform in the way of maritime discovery, except in exploring the northern extremities of the American continent. A series of voyages for this purpose was begun in 1818, conducted by Ross, Parry, and others, and which lately terminated by establishing the fact, that a passage for ships exists between the Atlantic and Pacific, round the northern promontories of America, but that, from the blocking of ice, such a passage can only be open to navigators on rare occasions, and is therefore of no practical value.

Utility of the Ocean. — The utility of the ocean in equalizing the temperature of the globe, in furnishing a highway for the intercourse of nations, in supplying an unfailing fountain of salt for the use of man, in providing an exhaustless storehouse of food, — has attracted the attention of every reflecting mind. There is another source of interest in this grand feature of nature, which is less obvious, but still hardly less important, — we mean, its moral and poetical associations. The influence of these upon the mind is beautifully set forth in the following passages.*

"The ocean is wonderful and divine in its forms

* From "Religion of the Sea," by F. W. P. Greenwood.

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and changes and sounds, in its grandeur, its beauty, its variety, its inhabitants, its uses and its mysteries, in all that strikes the sense and is immediately apprehended by the understanding. But besides all these, and lying deeper than all, it possesses a moral interest, which is partly bestowed upon it, and partly borrowed from it, by the mind of man. The soul finds in it a fund of high spiritual associations. Analogies are perceived in it, which connect it most affectingly with our mortal life, with dread eternity, and with Almighty God himself, the source and end of all. And thus it becomes a principal link in that great chain of purpose and sympathy, with which the Creator has bound up all matter and mind, together with his own infinite being, in one consenting whole.

"The sea has often been likened to this our life. Poetry is fond of remarking resemblances between it and the passions and fortunes of humanity. Our contemplations launch forth on its capacious bosom, and gather up the images and shadowings of our existence and fate, of what we are, and what is appointed to us. Do we see its multitudinous waves rushing blindly and impetuously along wherever they are driven by the lashing wind? They remind us of the tempest of an angry mind, or the tumult of an enraged people. Are the waves hushed, and is a calm breathed over the floods? It is the similitude of a peaceful breast, of a composed and placid spirit, or a quiet, untroubled time. Doubts, anxieties, and fears pass over our minds, as clouds do over the sea, tinging them, as the clouds tinge the waters, with their deep and threatening hues. Does a beaming hope or a golden joy break in suddenly

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upon us, in the midst of care or misfortune? What is it but a ray of light, such as we sometimes behold sent down from the rifted sky, shining alone in the dark horizon, a sun-burst on a sullen sea?

. . . . . .

"Thus discourses the ocean on the great themes of mortality, — the eloquent ocean, sounding forth incessantly, in its deep-toned surges, a true and dignified philosophy; repeating to every shore the moral and the mystery of human life.

"But it does something more. It is so vast, so uniform, so full, so all-enveloping, that it leads the thoughts to a sublimer theme than life or time, to the theme of dread eternity. When contemplations on this subject are suggested by it, human life shrinks up into a stream, wandering through a varied land, now through flowers, and now through sands, now clearly and now turbidly, now smoothly and quietly, and now obstructed and chafed, till it is lost at last in the mighty ocean, which receives, and feels it not. There is nothing among the earthly works of God, which brings the feeling, — for it can hardly be termed a conception, — the feeling of eternity so powerfully to the soul, as does the 'wide, wide sea.' We look upon its waves, succeeding each other continually, one rising up as another vanishes, and we think of the generations of men, which lift up their heads for a while and then pass away, one after the other, for all the noise and show they make, even as those restless and momentary waves. Thus the waves and the ages come and go, appear and disappear, and the ocean and eternity remain the same, undecaying and unaffected, abid-

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ing in the unchanging integrity of their solemn existence.

. . . . . .

"Where are the myriads of men who have trodden its shores, and gone down to it in ships? They are passed away. Not a single trace has been left by all their armaments. Where are the old kingdoms which were once washed by its waves? They have been changed, and changed again, till a few ruins only tell where they stood. But the sea is all the same. Man can place no monuments upon it, with all his ambition and pride. It suffers not even a ruin to speak of his triumphs or his existence. It remains as young, as strong, as free, as when it first listened to the Almighty Word, and responded with all its billows to the song of the morning stars.

"'Time writes no wrinkle on thine azure brow;
Such as creation's dawn beheld, thou rollest now.'

"It is this immutability, which, more than any other of the attributes of ocean, perhaps, impresses our minds with the sentiment of eternity, and gives to it its character of superiority among the works of God. Earth never frees itself entirely from the subjection of man. It constantly receives and covers his fallen remains, indeed, but is made to bear memorials of the victor, even after he is vanquished. All over the world we see the vestiges of former generations; their caves, their wells, their pyramids, their roads, their towers, their graves. But none of these things are on the sea. Its surface is unmarked but by its own commotions; and when it buries man or man's works, the sepulture is sudden and entire; a plunge, a bubble, and the waters roll on

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as before, careless of the momentary interruption of their wonted flowing. Thus immutable, thus unworn and unsullied is ocean. To what shall it be compared, but to the highest subjects of thought, to life and to immortality? It allies itself in its greatness more with spirit than with matter. It holds itself above subjection or control. It seems to have a will, a liberty, and a power.

"As these are high associations, they readily lead us up to Him who is above all height. There is a natural connection between all sublime and pure sentiment and the conception of Deity. All grandeur directs us to him, because we have learnt that he is greatest. We cannot stop in the creature after we have received any true ideas of the Creator. And thus God himself comes, as if by an influence of his spirit, into our minds, when we are looking upon the sea, or listening to its roar, and imbibing the emotions which it is so powerful to excite. Where he comes, he reigns. The conception of God, when it enters, takes the throne of authority among the other thoughts, and brings them into easy subordination. And then we think how inferior and dependent are all might and majesty, compared with his. The eternity of ocean becomes a brief type of the eternity of him who made it, and all its grandeur as a passing shadow of his. It does not, however, lose any of its interest, by this kind of inferiority. Nothing is lessened to the pious mind by being esteemed less than the Supreme. It retains its connection with eternity and God, and is exalted by its glorious dependence. It puts on the aspect, and speaks with the added solemnity of religion; telling us that

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all its power and magnificence are from the Maker, and that if it is full of beauty, and life, and usefulness, and mystery, it is because the Maker is good, and wise, and infinite.

"The sea has been called the religious sea. It is religious, as it suggests religious thoughts and emotions. And as the feelings excited by a noble object in a contemplative soul are always in some degree reflected back upon that object, the sea will appear to be in its own self religious; to know that it is lying in the hollow of the Almighty's hand; to chant loud anthems to his praise in the noise of its rushing floods, and to send up its more quiet devotions in the breathing stillness of its calms. In short, we know nothing of the sea as we ought to know, we feel nothing of its best and sublimest inspirations, unless we receive from it, and communicate to it, the thoughts and feelings of religion; unless we grow devout as we gaze, and return from contemplating it with the consciousness that we have entered into a nearer union with God."

CLIMATOLOGY.

THE climate of a country comprises whatever relates to the degree of heat and cold to which it is subject, the dryness and moisture of the air, its healthfulness or insalubrity. The causes which affect and determine the climate of a place are nine; 1. the action of the sun upon the atmosphere; 2. the internal heat of the globe; 3. the height of the place above the

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level of the sea; 4. the general exposure of the region; 5. the position of its mountains relatively to the cardinal points; 6. the neighbourhood of the sea and its relative position; 7. the geological character of the soil; 8. the degree of cultivation which it has received, and the density of the population collected upon it; and 9. the prevalent winds. These causes, acting together or separately, determine the character of a climate as moist and warm, dry and warm, mild and moist, mild and dry, cold and moist, cold and dry, &c.

The torrid zone has but two seasons; the wet and the dry. The latter is considered as the summer, and the former as the winter of the regions within this zone, but they are in direct opposition to the astronomical seasons, as the rains follow the sun. In some districts there are two rainy and two dry seasons every year. The temperature is uniform to the distance of ten or fifteen degrees from the equator, but in the neighbourhood of the tropics there is a great difference between the temperature when the sun is in the zenith, and when he is in the opposite solstice of any place. The climate of the equatorial zone is more temperate than that of the tropical regions, in which extreme heats prevail during the presence of the sun.

In the temperate zones only is the year divided into the four seasons, exhibiting the grateful vicissitude of heat and cold, the varied charms of spring and autumn, the tempered fires of summer, and the healthful rigors of winter. This regular succession of the annual changes can, however, hardly be considered to extend further than from 35° to 60° of latitude.

In the frigid zones two seasons only are known; a

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long and severe winter is abruptly followed by the insupportable heats of a short but burning summer; this harsh transition and strong contrast is occasioned by the great length of the summer days, and the total absence of the sun in winter.

There is a remarkable difference in climate between the eastern and western shores of the two continents, the latter being considerably milder. Thus along the shores of Europe the climate is from eight to ten degrees warmer, especially in winter, than on the opposite American coast in the same latitudes. Paris, which is about eight degrees north of New York, has a milder winter climate than the latter city. The western coast of the American continent, toward the north, has also a milder climate than the opposite shores of Asia, in the same parallels.

The extremes of temperature are experienced chiefly in large inland tracts, and are little felt in small islands remote from continents. In the United States, intense cold is felt when the wind blows from the frozen regions round Hudson's Bay. From snow-clad mountains, gusts of cold wind, called *snow winds*, rush down and cool the adjacent plains. The heat accumulates to an astonishing degree when the wind passes over extensive deserts of burning sand, which are said in some instances, in Africa, to be heated to the boiling point. This fine sand, or rather dust, sometimes rises in the air and obscures it like a fog, communicating to it an intolerable heat. In Arctic countries the temperature is very much regulated by the freezing of the water and the melting of the ice; by the freezing of the water great quantities of heat are given out, which

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moderate the severity of the winter's cold, and thus save from destruction the Arctic land animals and plants; while in summer, the intensity of the heat, produced by the long continuance of the sun above the horizon, is moderated by the abstraction of a considerable portion of that heat by the water during the melting of the ice. Had the Arctic regions been entirely of land, neither plants nor animals could have existed in them: for during summer, owing to the sun remaining above the horizon for months, an elevation of atmospheric temperature would have been produced fatal to animals and plants; and in winter, the long darkness and intense cold would have proved equally fatal to animated beings. The cold of the icy regions of the north has been alleged to reach southern latitudes, by currents of air, and thus to lower their temperature.

METEOROLOGY.*

THE ATMOSPHERE. — The air in which we breathe, with the clouds and vapors floating in it, surrounds the earth on all sides to an unknown height, and forms a movable envelope denominated the *atmosphere*. The human species and other land animals, being thus entirely immersed in this fluid, may with some propriety be said to inhabit an ocean as really as the fishes which live in the great deep. But the latter have the advantage in being able to mount up, remain,

* For a fuller view of Meteorology, see "Glances at the Sciences."

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or descend, at pleasure, in their element; whereas, without some additional aid, we must content ourselves with the more humble allotment of remaining on the bottom of our ocean. The winged tribes, doubtless, have the power of ascending to great heights; still they can never reach the summit.

There is nothing more essential to the existence or health of man himself, or of the inferior animals and vegetables which live on our globe, than the atmosphere; nor has any agent a greater share in the innumerable changes which are daily taking place in the inanimate materials composing our planet. That it is a body or substance possessing the essential properties of matter appears from the resistance which it offers to the occupation of its place by other bodies. Thus, if an apparently empty glass jar be inverted, and then immersed in a vessel of water, that liquid will only enter a very little way into the jar, the rest being occupied by the air. This familiar experiment shows that air is a body, by its resisting the entry of the water. At the same time, it shows the air to be an elastic or compressible substance, otherwise it would have completely excluded the water. That it is a fluid is evident from the ease with which bodies move in it, from its pressing equally in every direction, and passing with great facility through minute openings.

In respect to the composition of the atmosphere, vague and fanciful notions prevailed for many ages. The ancients considered it as one of the four simple elements of which they supposed all other bodies to be compounded. These were earth, air, fire, and water. How far the opinion was correct which made fire an

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element is a question on which nothing is yet known; but the researches of modern chemistry have shown that the other three are all compound bodies. The chief, and perhaps the only essential component substances in the atmosphere, are the two gases called oxygen and azote; its other ingredients, occurring only in small and variable quantities, are rather to be considered as foreign bodies.

Dew. — This is a remarkable product of atmospheric moisture. The quantity of aqueous vapor which can exist in a given space, as a cubic foot, is generally believed to be the same, whether there be air present in the space, or nothing but the vapor alone. The quantity is always the same at the same temperature, but it is greater as the temperature is higher; and, therefore, supposing the space to be saturated with vapor at a particular temperature, a portion of this will return into drops of water whenever the temperature falls. It is on this principle that a cold body, such as a bottle of liquor, being carried into a warm, moist apartment, becomes bedewed on the outside, till, perhaps, the water trickles down its sides; the contact of the cold surface chills the air, which in return deposits a portion of its moisture. Now this is similar to the mode in which moisture is insensibly deposited from the atmosphere on bodies at the earth's surface, and which is known by the name of dew. All bodies placed in still air, and exposed to the aspect of a clear sky, are found to become colder than they would be if some screen or awning were interposed between them and the sky. In such circumstances, bodies become much colder than the surrounding air, which, if sufficiently moist,

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deposits on them a portion of its moisture or dew. When the temperature is low, the dew is frozen and forms *hoar-frost*.

Dew never occurs in nights both cloudy and windy; and if, in the course of the night, the weather from being serene should become dark and stormy, dew which had been deposited will disappear. In calm weather, more dew will appear if the sky be partially covered with clouds than if it were quite clear. It often happens, that, even before sunset, dew begins to adhere to grass in spots which are sheltered from both sun and wind; for in clear weather such spots suffer much from the chilling aspect of the sky, and may often continue to acquire dew during the whole night, and for some time after sunrise. The quantity of dew depends on the moisture of the air, being greater after rain than after long continued dry weather.

CLOUDS. — Regarding the mode in which clouds are suspended in the air, philosophers are not agreed. About the commencement of the last century, it was supposed that the aqueous particles of clouds were in the form of hollow shells, specifically lighter than the air in which they float. But as no evidence or probability could be adduced in favor of this theory, it has given place to other speculations; and, at present, we may consider the suspension of clouds as an electrical phenomenon.

RAIN, SLEET, HAIL, &c. — As a greater quantity of moisture can exist in a given space as the temperature is higher, it is plain that there is a certain temperature at which air containing some moisture will just be saturated, and which is called the point of deposition, or the

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dewing point; for if cooled the least beyond this the air will deposit moisture. When the cooling in the body of air below the dew point is very slight, the effect is merely to disturb the transparency, or produce a fog. In the case of dew, formally considered, the transparency is not affected; because it is not the *mass* of air that is cooled below the point of deposition, but only a minute portion of it that comes into contact with surfaces cooled by radiation. When the cooling of a body of air beyond the dew point is considerable, the water is deposited more copiously, and, collecting into drops, descends to the earth in the form of *rain;* or if the temperature be sufficiently low, the drops are partially frozen, and form *sleet;* if fully frozen, *snow;* and if such drops be large and compact, they receivd the appellation of *hail.*

Rain is very unequally distributed to the different regions of the globe; but nature has so arranged it, that it is most copious in those latitudes where evaporation is most rapid. There are, however, exceptions to this rule; for on several tracts of the earth's surface, it hardly ever rains. These are usually far inland, ane are generally extensive plains, utterly sterile and uninhabitable. The want of rain is in some places partially supplied by the copious deposition of dew. On the contrary, there are some spots where it always rains, and which are mostly on the sea. As the whole atmosphere when fully charged with humidity is calculated to hold no more water than would form a sheet five inches in depth, while the mean annual deposit is about thirty-five or forty inches, it is plain that the supply must be frequently renewed. Rain is more abundant

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toward the equator than the poles, — at the sea-coast than towards the interior, — and on elevated stations than on plains.

GLACIERS. — Ice and snow absorb a large portion of heat during liquefaction, which they give out again on freezing; for, in the ordinary process of nature, water does not cool below 32° Fahrenheit, till the whole be frozen; nor does its temperature rise above that point, while in contact with ice and snow, — that is, till the whole be melted. This property has an important effect on the temperature of snowy districts. It retards and often prevents the occurrence of extreme cold, and it opposes a sudden rise of temperature above the freezing point. The cold in the atmosphere, as was formerly stated, continually increases with the elevation; and at a certain height, depending on the climate or latitude, perpetual frost prevails. Where the earth's surface attains this height, it is, with the exception of some steep or vertical cliffs, continually covered with snow. The snow acquires new additions from time to time; for though it may melt slowly, from the heat of the ground on which it rests, yet it suffers little decay externally, except what the air carries off by evaporation. The warmth of the solar rays may soften it a little, but this only tends to its farther consolidation. Masses of this soil are called *glaciers*.

By accumulating in the manner just mentioned, they often become top-heavy, or acquire such an enormous weight as to break their hold or crush their lower parts, which are besides liable to be undermined by the warmth of the mountain on which they rest. Hence, it not unfrequently happens, that huge masses of ice,

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or conglomerated snow, slide or roll down the sides of mountains, transporting, perhaps, large stones or fragments of rocks to which they had adhered, or which had been separated from their beds by the agency of the weather. Detached glaciers often descend into districts having a mean temperature considerably above the melting point of snow. But so great is the heat consumed in liquefying such huge masses, that years may elapse before they entirely disappear; and during that interval others descend; and so on continually, so that the limit of perpetual snow may be found in a climate where little snow falls from the clouds. When glaciers descend into the sea, and particularly when detached and floating, they are termed *icebergs*.

The Rainbow is a circular image of the sun, variously colored and produced thus: — The solar rays, by entering the drops of falling rain, are refracted to their farther surfaces, and thence, by one or more reflections, transmitted to the eye. But on escaping from the drop they undergo a second refraction, by which the rays are separated into their different colors; and in this state are exhibited to an eye properly placed to receive them. The rainbow is never seen but when rain is falling, and the sun and bow are always on opposite sides of the observer.

Looming, &c. — This is the term used by sailors to express a curious optical deception by which objects come into view, though materially altered as to their real situation or position. The French call it *mirage*, and the Italians *Fata Morgana*. It often happens at sea, that a distant ship appears as if painted in the sky, perhaps in an inverted position, and not supported by

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the water. Sunken rocks and sands appear as if raised above the surface. The Swedes long searched in vain for an illusory island of this sort, which they saw from a distance, as if placed between the isles of Aland and the coast of Upland. The shipping and the buildings on the shore of Naples have, from Messina, sometimes appeared floating inverted in the air. In 1798, the French coast appeared distinctly raised above the sea, for an hour, as viewed from the opposite shore of Sussex. To the French, while marching in the Egyptian deserts, the sandy plain, covered in the distance by a dense vapor, presented the illusive image of a vast lake, towards which they hastened, but never could reach it.

Aurora Borealis, or northern light, is a remarkable luminous phenomenon which occurs during night, and most commonly in clear or frosty weather. It is unknown in low latitudes, and becomes more frequent as we recede from the equator. But it is doubtful if its maximum either as to frequency or brilliancy be at the pole, for in the late north-polar expedition it was seen to the south of the observer, whereas, at greater distances from the pole, it appears to the north, or a little to the west of north, of the spectator. It is usually of a reddish color, inclining to yellow, and sends out frequent coruscations of pale light, which seem to rise from the horizon in pyramidal, undulating forms, and shoots with great velocity towards the zenith. Some maintain that a whizzing noise accompanies this phenomenon, but this is not very well ascertained.

St. Elmo's Fire is a faint light which seems to adhere to the points of bodies carried swiftly through

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the air. It appears on the tops of ship-masts, and at the points of spears and other warlike instruments when in motion. It is generally believed to be an accumulation of electric matter. A single flame of this sort was called by the ancients *Helena*. When seen in pairs, they were called *Castor and Pollux*.

Fire-Balls are those luminous bodies which appear usually at a great height above the earth, and were on that account long known by the term *meteor*, which is now applied to many other aerial phenomena. They present a very imposing appearance, and are seen of an immense size, sometimes red, but oftener of a vivid, dazzling white. They traverse the atmosphere with amazing velocity. This, and their great height, have been inferred from their being seen from various distant places, almost at the same instant; sometimes, they burst in pieces, or discharge torrents of flame, with a detonation making both the air and earth to tremble. Some of these balls descend like lightning, break through roofs of buildings, destroy animals, and shatter vessels at sea; in short, they are often attended with all the disastrous effects of thunder and lightning, with which they are occasionally accompanied. Some consider these balls to be great masses of electric matter passing from one place to another; others suppose them to be the same with the *aerolites*.

Aerolites, or meteoric stones, have frequently descended from the atmosphere, from the remotest antiquity. Both the above opinions may be correct, inasmuch as the fire-balls exhibit very different appearances. Philosophers are very much divided regarding the origin of meteoric stones. Some imagine

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them to be ejected from volcanoes on the earth's surface; others from volcanoes on the moon.

FALLING STARS are very ordinary phenomena everywhere, but still they belong to a class that is not well understood. Near the place of their apparent descent a fetid, gelatinous substance has frequently been found, of a whitish yellow color.

WINDS are currents of air occasioned by the disturbance of the equilibrium of the atmosphere by the unequal distribution of heat. The general tendency in such circumstances is, for the heavier columns to displace the lighter, and for the air at the earth's surface to move from the poles towards the equator, in consequence of the rotation of the earth on its axis; another motion is combined with the currents thus produced.

A variety of local winds have also been observed. The *Etesian*, which is a northerly or northeasterly wind, prevails very much in summer, all over Europe. Pliny describes it as blowing regularly in Italy for forty days after the summer solstice. It is supposed to be a part of the great lower current moving towards the equator. Another northern wind, which often continues about a month in February and March, is called the *Ornithian* wind, because some birds of passage then make their appearance in the South of Europe. A *squall*, or sudden gust of wind, is common in many places; and when its impetuosity is sufficient to bear along trees, buildings, &c., it is called a *hurricane*. Such winds have frequently a whirling motion, and are accompanied with torrents of rain or hail, and even thunder; these are sometimes called *tornadoes;* they

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are principally confined to the torrid zone. The *Sirocco* is a hot, southern wind, known on the shores of the Mediterranean; when it reaches Naples and Sicily, it is very moist and relaxing to the human frame. Some warm climates are occasionally visited by excessively hot, pestilential winds, generally from the south, and known under a great variety of names in different quarters. Such are the *Kamsin* in Egypt, and the *Simoom* or *Samiel* of Arabia and the desert. The deleterious effects, which frequently cut off whole hordes or caravans, are sometimes ascribed to the predominance of one of the component gases of the air, or to a mixture of nitrous gas, &c., but this is not well ascertained. The very arid state of the air, bearing along vast quantities of burning sand and dust, must of itself be very prejudicial to animal life. The *Harmattan* is a warm, dry, east wind, which occurs in Guinea, and is also of a very unwholesome description.

The velocity of the wind varies from nothing up to one hundred miles an hour; but the maximum is variously stated by different authors. According to Smeaton, a gentle breeze moves between four and five miles per hour, and has a force of about two ounces on a foot; a brisk pleasant gale moves from ten to fifteen miles, with a force of twelve ounces; a high wind thirty to thirty-five miles, with a force of five or six pounds; a hurricane, bearing along trees, houses, &c., has a velocity of one hundred miles, and a force of forty-nine pounds on the square foot.

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THE VEGETABLE KINGDOM.

The diversified forms of vegetation are usually classed under three heads, as trees, shrubs, and plants; but, botanically speaking, they are all regarded as plants. The whole number of species ascertained is about eighty thousand, but probably as many more remain to be discovered. They are all divided into two kinds, the *Cryptogamia*, or non-flowering plants, as fungi, mosses, lichens, sea-weed, &c., and *Phænogamia*, or flowering plants.

All plants are propagated by seeds, but those of the cryptogamia are so minute as to have escaped detection for a long period, and their mode of production was till recently hidden in obscurity or doubt.

All vegetables,* in every region, have these properties, in common with all animals and with the human race: — organization; an interior power of progressive growth; a principle of life, with many phenomena that resemble irritability, excitability, and susceptibility; and a self-reproductive and multiplying faculty. In all these qualities they are distinguished from inorganic and earthy matter, and from all fluids and gases; and by these are raised high in the scale of being above them. In these they resemble all animated nature, and our prouder selves. We may dislike such a relationship, but to this extent our bodily frame and functions establish a natural kingship between us. They

* We here quote from Turner's "Sacred History," to which we are indebted for several interesting passages inserted in the subsequent pages.

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are very humble cousins, but we cannot destroy the organical and living affinity, nor escape the closing assimilation. We decline and die, as they do; and they sicken, fade, die, and decay, like every human being. There is also another analogy. Their substance nourishes us, and ours not unfrequently becomes a part of theirs. They can feed on us, as we more continually and universally do on them. All living nature is linked together by actual connection, if not by perceivable sympathies.

It is not merely in their principles and analogies of construction, nutrition, and growth, that plants resemble animals; but the creative hand has linked and established the affinity between them by causing some vegetables to produce animal products, and to be, as it were, the animals whose peculiar properties they imitate. Thus their living principle, in peculiar and adapted organizations, can imitate the bee, the cow, and the sheep; for the Myrica Pennsylvanica yields an annual supply of vegetable wax; the Palo de Vaca, in South America, gives a copious emission of actual milk; and another tree, in Guayaquil, produces a fine wool; while one in China secretes a tallow, like animal fat. The Tillandria, of Buenos Ayres, resembles another element, in becoming a kind of vegetable fountain, for it yields on incision a copious quantity of pure water. They have even some relations, yet unexplored, with the mineral kingdom; for they not only form the carbon they contain, but some have been found to have copper particles, and several to secrete flint, and likewise sulphur, as in our common grain. We may add iron and gold also, for both of these metals have been found

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in vegetables, and more especially the former. Thus all the departments of nature have been made with mutual associations.

The food of plants peculiarly distinguishes them from animals. While these subsist only on what has been organic matter, vegetables derive their nourishment from that which is inorganic, as mere earths, salts, water, or the gases. The particles of these become arranged in them, by the agency of their living principle, into organized substances, and by this mysterious process are fitted for animal nutrition. The vessels of vegetables are so fine in their radicles and leaves, and in the smaller plants, that the particles which they imbibe must be in the most attenuated state. They are injured, like animals, by too great a supply of what they feed on; and hence many plants decline or perish on too rich a soil. Each will grow only on that kind of ground which suits its organs or appointed functions.

The kindred nature of all plants is surprisingly shown by the power and effect of their growing and fructifying when grafted on each other, — one organization attaching its vascularity to that of another, and feeding on its sap. The ancients took some pleasure in these experiments, for Plutarch saw, and notices, in a garden on the Cephissus, an olive upon a juniper, a peach upon a myrtle; pears upon an oak, apples on a plane-tree, and mulberries upon a fig. In Holland a rose was grafted on an orange-tree; and in our times, carnations have been ingrafted on fennel, and a peach upon a mulberry. So an inhabitant of Lyons inserted on the same stem red and white grapes,

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peaches, and apricots. Such facts prove the absolute similarity in nature of the different classes of the vegetable kingdom. Their general system and principle of life are the same. It is the specific and purposed variation of their organizations, which, from the same material elements, causes the specific diversities of their products to appear. No result is a random accident.

Plants have been manifestly designed and framed on the principle of improvability. This also highly distinguishes the latent powers of their living principle, and its vast superiority over inorganic matter. It is a truly wondrous faculty, for it is one of the greatest distinctions of man. Animals have it to a certain degree, but very limited, and apparently far less than vegetables. The productivity of animals cannot be increased like that of plants. The human capacity for progression is not more clearly visible than that of which so many vegetables have been found susceptible, and it may not unreasonably be inferred to be a law of their constitution. Very agreeable, but surprising, transformations have arisen from this property. The rose is the product of cultivation. The original plant from which all our beautiful varieties have proceeded is considered by botanists to be the common wild brier. Our plums are the cultivated descendants of the sloe; the peach and nectarines, of the common almond-tree; filberts are the improvements of the wild-hazel; the delicious apples, whose species may be now reckoned by hundreds, are the cultured successors of the small austere crabs and wildings, which swine will scarcely eat; the original

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pear is a petty fruit, as hard and crude as the crab-apple. Our grain was once in a state very like grass; our cauliflowers, cabbages, and other domestic vegetables, are the artificial products of human skill and of vegetable improvability.

The vegetable kingdom, in its varied flowers, foliage, stems, and graceful and delicate expansions, in its playful branches and gentle movements, and in its multiplied fruits and useful products, of numerous sorts and of universal application, displays a peculiar goodness, liberality, and kindness in the Divine Mind towards his human race, — a desire to please, to interest and to amuse us with the most innocent, continual, accessible, and gratifying enjoyments. For, plants peculiarly address themselves to three of our most used senses, — the taste, the smell, and the sight; while the ear is also soothed by the whispering of the branches, and the touch by the softness of the verdant and floral foliage, and of most of the fruits.

The rudest as well as the most refined minds feel and confess the beauty of plants, and in all ages have availed themselves of it for personal decoration. Anacreon sweetly sings his delight derived from vegetable nature, — and especially the rose, — though he also twines the lily and the hyacinth round his forehead, as an attractive and festive ornament. The presence of flowers, and the scenery and companions which always surround them, have excited in many poets, of all nations, their finest thoughts and feelings. As in one of the delicious passages of MILTON, which has never been excelled: —

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"Sweet is the breath of morn; her rising sweet,
With charm of earliest birds: pleasant the sun,
When first on this delightful land he spreads
His orient beams, on herb, tree, fruit, and flower,
Glistering with dew: fragrant the fertile earth
After soft showers; and sweet the coming on
Of grateful evening mild: Then, silent night,
With this her solemn bird; and this fair moon,
And these, the gems of heaven, her starry train.
But neither breath of morn, when she ascends
With charm of earliest birds; nor rising sun
On this delightful land; nor herb, fruit, flower,
Glistering with dew; nor fragrance after showers;
Nor grateful evening mild; nor walk by moon,
Or glittering starlight, without Thee, is sweet."

It has been a favorite theme to the imagination to fancy, or to sing, that herbs, and flowers, and trees could sympathize with human sorrow. Thus Moschus, in his Greek hexameter epitaph on Bion, indulges the supposition of the possible sensibility of vegetable nature: —

"Mourn with me, ye plants! woods! now bewail!
Sigh, O flowers! from your sorrowing stems;
Blush mournfully, ye roses! anemone!
Hyacinth! now speak in your symbol letters,
And by your floral leaves more than common
Express your tokens of grief. The beautiful singer is dead!"

The Greeks used flowers as part of their funeral tributes of regard; and their priests consecrated to Iris the trees on which the rainbow seemed to rest. The Turks preserve the ancient use of flowers as symbols of the language of the feelings, and make them the silent and secret epistolary messengers of their sensibilities. They also apply them lavishly round the

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graves of those they love, to express their attachment and grief.

But however fanciful these ideas and customs may be, they bear evidence how eminently vegetable nature has at all periods and in all countries affected the imagination and the feelings of mankind. It is a fair inference from the universal fact, and from the concurring impressions on ourselves, that they were made to have this interesting effect, as well as to beautify our inhabited regions. But it is not an imagination — it is a sober reality — to say, that, wherever they have been cherished and cultivated, they have drawn the human spirit to seek and value the gentler and kinder dispositions and occupations of our movable, irascible, and sturdy self-will.

The utility of the vegetable creation is as apparent as its beauty. Without vegetation, none of the animals we know, but those that live on water or air, could have continued in existence; for neither man nor animal can subsist on any thing in the mineral kingdom, until vegetation, by first making it vegetable substance, has prepared it for a future conversion into their own. Hence the justness of the Mosaic account, in placing the creation of plants before that of animals. Vegetation could have remained without animals, — but these, unless their food had been ready for them, would, under their present economy of being, have soon disappeared.

While most of our plants thus form the sustenance and banquet of the animated kingdom, other classes of them were made and meant to be its natural medicines and secret physicians. For this purpose, those which

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thus benefit are universally dispersed. We may regard many of these as useless weeds, yet they silently spread amid all vegetation, to be everywhere ready for the general benefit. Brutes often need them as much as ourselves, and are repeatedly seen at particular times to select and crop the herbs that they do not use for food, but to which some recollected experience, or unexplainable perception or instinct, leads them, for their resulting efficiencies. Some of these useful plants are also so interspersed with their daily sustenance, that they cannot take the one without always digesting the other. But to man, plants have been in all ages the natural, and the earliest, and the most universal physicians. The metallic and mineral drugs of our modern pharmacopœias have not been above three centuries in their sanitary use. Vegetable medicines constituted the physic of our ancestors, as they still are of all nations who do not make European science their predominating guide.

When we consider that vegetation carpets all the surface of our globe; and that its shrubs and forests still occupy the largest portion of its superficial extent; and when we find that it is universally, by day and by night, streaming from its verdure, — from every leaf, fruit, and flower, — an aerial fluid of some sort or other, and in the lower region of the atmosphere, immediately over our heads, and mixing in the gaseous strata of it which we breathe; we shall perceive that it must be hourly causing the most important effects, additions, and changes in the air which we inhale, and must be a very essential and active agent on the vitality, functions, and powers of our material frame.

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But besides these uses of vegetation as medicine, it is also everywhere contributing to the comfort and convenience of man in his domestic and social life, according as his skill and diligence discover its applicable uses, and invent the means of making them advantageous to him. Hence the innumerable improvements in all the arts and manufactures which human ingenuity has appropriated, and which are daily increasing. This must be a familiar subject of observation to all. It will be sufficient here to notice only a few, as specimens of what thus abound.

Thus the sago palm-tree on the Orinoco supplies the Guanacas with all that they need. They live in it and upon it, with scarcely a possibility of exhausting its supplies. The banana is as bountiful a friend to myriads of our fellow-beings in the East, both in its produce, and its power of rapid multiplication. The Canadian birch-tree, in its mere bark, is a valuable supply of conveniences to the Indian nations. The breadfruit-tree has a bark from which the Tahitians make several varieties of their native cloth. Of the trunk they build their canoes and houses and their articles of furniture, and extract a valuable resin; and they live upon its abundant fruit. Their cocoanut-tree is still more serviceable for the conveniences, as well as food, which it profusely yields. The hemp, flax, and cotton plants are known to all.

Enumerations of this sort might be made from all the regions of the globe. Nothing is useless in vegetable nature. Even the thistles we despise and eradicate, the dandelion, which we ridicule, the nettle, which we dislike, and the rush, which we undervalue,

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are all convertible into beneficial uses. They have all, in some age or other, contributed to human comfort or convenience. The most intellectual of our arts, which gives to ideal beauty a visible form, is greatly indebted to botanical productions for some of those pleasing colors which imbody its conceptions. From them, also, many valuable dyes are obtained; and more are yet attainable by persevering experiment. Even the vegetation of the marshes, though unfit for alimentary herbs or for habitation, becomes serviceable by the turf which it produces, and is always renewing, as it is removed, for domestic comfort. The maritime also assists some portions of mankind with food and medicine, and materials for manufacture. The lichens likewise extend similar utilities to society; the fungi, though deleterious when unwisely applied, yet have properties that are available to medical skill; while ferns are not less auxiliary to our use and comfort.

These latter plants might seem among the least attractive in the vegetable kingdom; nay, some of them are even disgusting to the sight: yet they furnish as striking evidence of utility as even the higher forms of vegetation. The fungi, for instance, are observable in a great variety of forms, and, among others, mushrooms, toadstools, puff-balls, the fungous dry-rot, fermentation, mildew, and mould. We may take the last mentioned as about the lowest in the group. Mould, as most persons are aware, makes its appearance on the surface of various familiar objects, — decaying paste, fruit-preserves, cheese, and old shoes. It never appears on any thing which is new or fresh, but is always a harbinger of decay, and may be considered a first step

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towards the decomposition of the substance into its constituent elements. How vegetation should appear in so secluded a situation as the inner cracks in cheese, or in a jar of preserves placed carefully away in a cupboard, or on the leather of an old boot in the remote corner of a bed-closet, is at first sight incomprehensible; but a consideration of the reproductive powers of fungi at once explains the circumstance.

The whole of the fungous tribe possesses the most extraordinary productive powers. Instead of propagating by the ordinary and slow process of elaborating and throwing off seeds, they increase by the dispersal of their entire substance. Every particle in their mass is a germ, or technically a *spore*, which, though smaller in bulk than a particle of fine dust, and generally so minute as to be invisible to the naked eye, is the embryo of a new plant, and will develope its powers of vegetation as soon as placed in an appropriate situation for its growth. In this manner, a toadstool, having performed its office and exhausted its means of nourishment, shrinks, dries, and dissolves in millions of atoms, which, being liberated and floated away in the atmosphere, are deposited in every imaginable situation. Some are inhaled into the lungs of animals, while others enter into the fabric of trees and herbs, and, in short, they find admission into every exposed and penetrable substance. It is, however, a distinct principle in fungous vegetation, that it can develope itself only in decaying bodies. Decay, or liability to decay, is necessary for its fructification; and when this condition ensues, and other circumstances are suitable, the embryo expands and rises with surprising rapidity into notice.

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A very remarkable kind of fungous vegetation is known to make its appearance in wine-cellars, the substance which supplies the growth being the vapor from the wine in the casks or bottles. If the cellar be airy and dry, the vapor escapes, and no fungous vegetation is manifested; but if it be somewhat damp and secluded from air and light, the fungous growth becomes at once apparent. Round every cork a mould-like vegetation will exhibit itself, and the vapor from the casks, rising to the vaulted roof, will there afford nourishment to great festoons and waving banners of fungi. In the wine-vaults of the London docks, this kind of vinous fungi hangs, like dark, woolly clouds, from the roof, completely shrouding the brick arches from observation. On a small piece being torn off and applied to the flame of a candle, it burns like a piece of tinder. Should wine escape from a cask in a moist and ill-ventilated cellar, it will altogether resolve itself into fungi of a substantial kind.

The disease called rust, which affects grain in the ear, particularly in moist seasons, is well known to be a fungous vegetation, proceeding from germs which had previously existed in the substance of the plants. In a dry season, and on a favorable soil, rust rarely makes its appearance; certain conditions are necessary for its development, and it is by obviating these that the farmer must hope for exemption from this destructive malady in his crops.

Offensive in appearance as nearly all fungous vegetables are, and injurious as they may sometimes be to the crops of the husbandman, they perform a highly useful office in creation. Existing only by the absorp-

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tion of fetid exhalations, and rapidly depriving them of their insalubrious properties, they execute duties analogous to those of certain tribes of insects, — maggot-flies, for instance, — and in this respect have been appropriately associated with these animals as the "scavengers of nature." On this point in their economy, a naturalist observes as follows: —

"The peculiarity of their agency consists in their power of suddenly multiplying their numbers to a degree which could only be accomplished in a considerable lapse of time by any larger beings, and then as instantaneously relapsing, without the intervention of any violent disturbing cause, to their former insignificance. If, for the sake of employing on different but rare occasions a power of many hundreds or thousands of horses, we were under the necessity of feeding all these animals at a great cost in the intervals when their services were not required, we should greatly admire the invention of a machine, such as the steam-engine, which should be capable at any moment of exerting the same degree of strength, without any consumption of food during the periods of inaction; and the same kind of admiration is strongly excited when we contemplate the powers of insect and fungous life, in the creation of which nature has been so prodigal. A scanty number of minute individuals, only to be detected by careful research, and often not detectable at all, are ready, in a few days or weeks, to give birth to myriads, which may repress or remove the nuisances referred to. But no sooner has the commission been executed, than the gigantic power becomes dormant; each of the mighty host soon reaches the term of its

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transient existence; and when the fitting food lessens in quantity, when the offal to be removed diminishes, then fewer of the spores find soil on which to germinate; and when the whole has been consumed, the legions before so active all return to their latent unnoticed state, ready, however, at a moment's warning, again to be developed; and, when labor is to be done again, again to commence their work, either in the same districts, or to migrate in clouds, like locusts, to other lands. In almost every season there are some species, but especially in autumn there are many, which in this manner put forth their strength; and then, like the spirits of the poet, which thronged the spacious hall, 'reduce to smallest forms their shapes immense.'"

It will now be understood that mould is a fungous vegetation, produced by a previous deposit of germs in the tissue or on the surface of the object on which it grows. The proximate cause of its development is generally damp, and, without this condition, the embryo remains in a dormant state. Still, it may be asked, how cheese happens to have green mould at its very centre: the reply is, that the fungous germs floating in the atmosphere had various opportunities of finding admission into this article of diet. They may have been deposited on the grass of a field; the grass was eaten by the cow, and the germs were so lodged in the milk; or, what is more probable, the germs fell upon the curd, and there lay concealed till a certain dampness in the cheese brought their vegetative powers into operation. It is well known that the exposure of curd for a day to the atmosphere will have the effect of pro-

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ducing cheese liable to mould. The mouldiness of Stilton cheese is produced by practising this device. Those who wish to make sweet cheese, not readily liable to mould, should avoid exposing the curd to the atmosphere.

We may learn from these observations that the germs of fungi, necessary to produce dry-rot, mould, fermentation, and other species, are dispersed throughout all organic matter. Every thing we eat, drink, taste, or which ministers to our wants, contains the germs of fungi, and all that is required to bring them into visible operation are certain conditions of decay, heat, and moisture.

On the stones by the side of brooks we may sometimes observe a reddish coloring matter, which, if not caused by metallic ores, will generally be found to be a primitive kind of vegetation. When touched, it feels slippery, and, on examination by a microscope, it is observed to be formed of myriads of plants, each consisting of a small vesicle or globule, which, on arriving at maturity, expands, bursts, and liberates plants of its own species. This exceedingly humble plant is classed with the algæ, as being the nearest to it in character, although these plants are for the most part of a large size, and grow principally on rocks in the sea.

The object which nature has in view by the germination and dispersal of the algæ, mosses, and lichens, is clearly that of preparing the way for a higher order of vegetation. It cannot possibly escape our observation, that the tendency to vegetate is a power restless and perpetual. We hew a stone from the quarry and place it in a damp situation, on the ground or in a wall,

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it is all the same which, and shortly a green hue begins to creep over it. This is the commencement of a vegetable growth, produced by germs floated in the atmosphere, and being attached at random to the stone, have been brought to life through the agency of the moisture.

Nature is incessantly working out vast ends by humble and scarcely recognizable means. It seems to be a principle that nothing shall remain stationary or unchanged. The whole surface of our planet is every instant altering in its features. Mountains are being washed down into the plains, rocks are mouldering into soil, the sea is filling up at one place and encroaching on the land at another, and water-courses are constantly shifting their outlines. The duty of filling up seas, ponds, lakes, and rivers, is consigned to divers means within the animal and vegetable economy, and one of these is the growth of algæ and other aquatic plants. Take a pond of water, and shut off its means of supply from rivulets and springs, and then observe what an effort nature will make to fill it up. The sides and bottom become speedily covered with a luxuriant crop of confervæ; other plants, which grow only in water, begin to make their appearance, their seeds being wafted thither by winds; at length the superficial matting of herbage is able to support the weight of birds, grass grows, there is alternate vegetation and decay, and finally the pond is filled up. This routine is observable in many small lakes which are fed by weak springs, and except for an artificial clearing out occasionally they would in a short time become dry land. What, indeed, are the extensive peat-mosses

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but lakes and pools choked with vegetable matter, which remains in a half-consumed condition?

The importance of vegetation, in the economy of nature, is thus as apparent in the humbler, as the more imposing plants. The means adopted to cover every part of the earth with these agents display the wisdom of Providence, in a remarkable degree, in making various objects the instruments of completing its designs. We might naturally be at a loss to know how vegetation found its way to places that originally had none, and that are not likely to have been visited by what would bring them. How, for instance, could the frozen soil of New Shetland, amid the ice-rocks of the Antarctic, obtain the lichens, the only vegetable found, or perhaps growable, upon it? How have the coral islands of the Pacific, formed in the bosom of the waves by the petty animalculæ that construct them, derived their fine cocoanut-trees and beautiful forests? How can the new volcanic island that has just emerged from the shallow bottom of the Sicilian Sea, ever acquire, as it will do, a productive vegetation?

The answer is easily given. The clouds, ever floating above us, not only bring us occasionally meteoric stones, hail, and epidemics, but also vegetable seeds, and the very lichens that would commence the new reign of vegetation on the bleak rocks of the south-polar isles. Dust and sands, heavier than many seeds, are borne by the winds and clouds for several hundred miles across the atmosphere, falling on the earth and seas as they pass along. The cryptogamia, and many of the grassy seeds, are not more weighty than matter of this sort, which the aerial movement thus

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transports. The sea, and its tides and currents, convey larger bodies for even thousands of miles. The winds carry over the seeds of large trees, and disperse new vegetations with an extraordinary rapidity, and to an extent which, anterior to the experience, we should not have expected. Birds also largely diffuse them. Many of these tenants of the trees and air live on fruit and berries. They digest the pulp, but pass the seeds unimpaired; and thus heavy organizations of future trees are planted in the most distant and unexpected situations. The parasitical mistletoe, converted by the stern Druids of our British predecessors into an instrument of their governing superstition, and which they gathered from the tree on which it fed with such imposing solemnity, thus attains its lofty, and, in the days of ignorance, mysterious situation. The digestive action of the feathered race upon them improves, in some cases, instead of injuring their growing energy. Waves, winds, and birds fully explain the vegetations of every coral and volcanic island. The amazing muscular power and vital energy of birds to sustain their flights in their migrations, for distances that astonish us, will account for the plantations of the most distant isles and continents. Even insects people inland ponds and streams with fish, and are often themselves carried by the winds to great distances. Thus showers of their larvæ have often fallen from the clouds. From all these facts, no individual of right judgment can have any difficulty in perceiving how the most remote and unvisited regions have derived their varied vegetation. We need not have recourse to the unsupported hypothesis of spontaneous produc-

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tion, which no circumstance that has been fully understood has at any time occurred to prove. When once a vegetable has become rooted in a soil, it is capable, if unchecked, of spreading to an indefinite extent. One tree has, in some regions, propagated into a large forest. But the possible produce which may issue from a single individual of this department of nature, like other facts that we have noticed, extends into calculations which exceed our comprehending faculty.

We may close these remarks in the striking words of the author from whom we have largely quoted. The vegetable kingdom expands everywhere before us an immense portraiture of the Divine Mind, in its contriving skill, profuse imagination, conceiving genius, and exquisite taste, as well as its interesting qualities of the most gracious benignity and the most benevolent munificence. The various flowers we behold awaken these sentiments within us, and compel our reason to make these perceptions and this inference. They are the annual heralds and ever-returning pledges to us of his continuing beneficence, of his desire to please and to benefit us, and therefore of his parental and intellectual amiabilities. They come to us, together with the attendant seasons that nurse and evolve them, as the appointed assurances that the world we inhabit is yet to be preserved, and the present course of things go on. The thunder, the pestilence, and the tempest awe and humble us into dismaying recollections of his tremendous omnipotence and possible visitations, and of our total inability to resist or avert them; but the beauty and benefactions of his vegetable creations, — the flowers and the fruits more especially,

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— remind and assure us of his unforgetting care, of his condescending sympathy, of his paternal attentions, and of the same affectionate benignity still actuating his mind, which must have influenced it to design and execute such lovely and benevolent productions, that display the minutest thought, most elaborate compositions, and so much personal kindness.

THE ANIMAL KINGDOM.

We now come to that grand division of organized nature which presents us with an almost infinite variety of beings which *live*, *move*, and *feel*. These are arranged by naturalists under two divisions, namely, the Vertebrata, — those which have interior bony skeletons, and including quadrupeds, birds, fishes, and reptiles, — and Invertebrata, including those which have no internal skeleton, such as shell-fishes of all kinds, every variety of insects, the gelatinous animals of the sea, as polypi, and the five-fingered jack, the infusoria, &c. These are again classed under different heads,* according to certain peculiarities. In the following sketch, we propose only to give a view of some of the most striking traits of the leading animal tribes.

General Characteristics of Quadrupeds. — Linnæus distinguished the quadrupeds of the earth into six orders, and added another for the cetaceous fishes,

* For a classification of animals, see "Illustrative Anecdotes of the Animal Kingdom."

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giving them the general title of *Mammalia*, as they have all been created with the peculiar habit of maturing their offspring in a similar manner to the human race. These seven orders, subdivided into forty-eight genera, include above eight hundred species. The characters of the orders were taken by Linnæus from the number, situation, and structure of the teeth: the arrangement of Cuvier, now generally adopted, is founded upon the anatomical structure of the body.

That animals* have organs of sense corresponding with those of man, we all familiarly know. They see, hear, taste, smell, and feel, as well as we do, and some much more acutely. Both the dog and the wolf have an exquisite sense of smell; the cat, and some others, can see in the dark; the lynx is acute both in sight and smell; the raccoon is peculiarly sensitive in both smell and touch. Others have a quickness of hearing superior to ourselves; and some appear to be impressible by musical sounds. In the evolution of the animal embryo, the formation of its nervous system appears to precede its circulatory functions and fluid. Some curious experiments seem to show that the principle of life is independent of the nervous matter, as it continues in the body of some species for some time after the brain and spinal marrow are removed.

All the quadrupeds utter sounds of some sort or other, which they can vary into so many tones as are necessary to give vent to their feelings, to denote their wants, or to communicate with each other. Whoever

* We copy the greater part of this article, also, from Turner's "Sacred History of the World."

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attends to the poultry-yard will soon perceive that each species uses particular modifications of sound, to signify to their brood and fellows what they wish them to understand, and each seems perfectly to comprehend the meaning of the speaker. Many animals have been remarked for their communications, by utterance, to each other. The sloth, in the modifications of its plaintive cry, ascends and descends regularly through six musical notes; one monkey has been noticed to utter vocal syllables; and dogs have been taught to express human words, even so large a number as thirty, intelligibly. The monkey tribe give strong indications of mutual communication and comprehension by their vocal utterance.

It is one of the great distinctions of the animal mind, and of its similarity, within its prescribed scale and compass, to our own, that it is both teachable to several intelligent actions, and also susceptive of moral docility. Thus far it is improvable, but not beyond. By this limitation, it is divided from the human soul, of which an indefinite and unceasing improvability is its universal property, though the largest part of mankind but little avail themselves of it. But that degree of moral ductility and capacity of education which taming exhibits seems to be a general quality of the animal mind, as the fiercest have been subjected to it. Of the Feræ genera, which includes all the wild and ferocious, the largest have been found tamable. Even the tiger, who may be considered as the fiercest of the fierce, has exhibited this improvability; so has the savage and voracious hyena; crocodiles have been made harmless and docile, and the leopard likewise; the wolf has

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also shown that it possesses what we may term affectionate docilities; the baboons become vigilant guardians of their protectors' property. These facts prove that there is nothing in the nature of the wildest animals to make their gentleness and sociability either impossible or improbable. We see by the dog and cat that the carnivorous may be mild and friendly; as we find those which feed on grass and herbs may be wild. Even now the devourers and their prey may, by kind and judicious management, be trained to live peaceably and harmlessly together. Nothing appears more effectual to produce this pleasing melioration than patient and persevering kind and gentle treatment. They are now wild and savage, from the appointed circumstances amid which they are at present ordained to live; and when this state of the general world shall be altered, their moral transformation will become a natural appendage to the great social and intellectual revolution which the Hebrew prophets attach to the ulterior ages. It is in quadrupeds as in fish, — the largest are the mildest. The vast hippopotamus, the rhinoceros, and the elephant, are as gentle and harmless as the sturgeon and the whale.

That animals have feelings and passions very analogous to our own appears from many instances. Our rugged or oppressive conduct towards them more usually puts their resentful emotions into action than their better capabilities; and this has caused their angry humors to be most frequently noticed. But many species show what must be called kind affections. Monkeys display them toward each other. Cows will protect each other, and feel strongly for their young. Most an-

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imals evince pleasure at being caressed. Bears have exhibited strongly both connubial and maternal sensibilities. The beaver has felt or imitated them. Lions also discover the same sympathies to be within them. So have the unmanageable elks. The apes and orang-outangs have repeatedly indicated affectionate sympathies. Even the hog we despise is not destitute of them; it is peculiarly sensitive of weather, and naturally select in its food. But all classes of animals, from the greatest to the least, have given striking demonstrations that their mental principle has these moral sensibilities as truly as the superior human spirit.

From a consideration of these traits in quadrupeds, let us pass to the consideration of their indications of a perceiving, attending, and thinking mind.

To collect provisions for their future use, to hoard them in safe places, and to use them gradually for their daily sustenance, are actions in the human race which display and require great prudence, foresight, just reasoning, will acting upon judgment, and much self-command. A very large portion of mankind will not exert either this forethought, or the self-government that alone makes it effectual. The Scottish nation may be cited as an example of the former qualities, while the lower Irish are too often conspicuous for the want of them. Yet they are strikingly exhibited in the Alpine hares, who literally make hay for their winter food; in the active and provident squirrels; in the ingenious beaver; and by many of the Glires genus.

The tuition which quadrupeds are capable of receiving discovers a lower degree of that improvability

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which distinguishes our superior race, which, as far as it extends, resembles ours, although at the same time it marks its specific difference by its unvarying limitation. Apes have often amused their possessors by their imitative faculty. Cats display this teachability. Pigs have also repeatedly shown that they can learn to do things not natural to them. A sow has been trained to the services of a pointer.

The quadruped animals, of their own will and nature, and from inborn instincts, do actions which require knowledge, reasoning, and judgment in mankind. Reindeers follow and obey leaders of their own species. Elephants also make their journeys on this plan, when they deem it necessary. Baboons have been found to make defensive arrangements, resembling military tactics. Mules and cats make signals to have a door opened. Bisons place themselves in the best position for repelling an enemy. The black bear's mode of fishing is as dexterous as any schoolboy's could be, but more patient than he would be. Even the selfish depredation of the monkey, too craving of others' food to be sufficiently careful of his own, was an intellectual action. All these display what many human beings would do in the same circumstances, and for the same ends.

Deliberating, judging, and persevering mind, with real building skill, appears as much in the beaver's construction of his cabin, as in any human fabrication of a cottage. The curiosity of a petted weasel resembled the same quality in its mistress. If it be foreseeing caution in a military officer to place sentinels to watch and give alarm on danger, is it any other quality

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in animals who use the same precaution? Marmots do this. So do the baboons and monkeys of Africa; the wild asses likewise, and many other classes. If the assembling in societies occurs among mankind from a sense of mutual wants, safety, and benefit, and from sympathies that we term moral, must there not be some feelings or notions analogous to these in those species of quadrupeds who voluntarily associate together? The social mouse is a pleasing instance of these sensibilities; they pair, form families, and live together as neighbours. The beavers unite, from a distance, into societies, for the express purpose of building their habitations in vicinity to each other, and coöperate in their labor, like Dido's followers in the Virgilian picture of their founding Carthage, or like emigrants into our western wilds, to build their log-houses and forest towns. The marmots as assiduously join their skill and industry together to form their social rooms, as any body of bricklayers and carpenters to raise the edifices they construct. Several other species of animals also shape their habitations by concurring labor.

All the instances which occur, in these classes of beings, of coöperating action for some common end, show the intention and the desire to unite their efforts for that purpose, and, therefore, a mind, or a meaning and thinking power, that designs, perceives, comprehends, wills, and operates to produce it. Individual instances of what in human beings we should call contriving mind have been remarked in animals. The squirrel's mode of passing a river, — the jerboa's provision for his escape if attacked in his retreat, — the opossum's mode of obtaining crabs which his paws

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cannot reach, — the monkey's use of his tail as a hand or finger, — the Peruvian hare's two chambers for distinct uses, — the otter's providing against the rise of the tide or river, — the honey-weasel's averting the glare of the sun, — the monkey's imitation of the astronomers who were measuring the length of a degree in Peru, — the Indian monkey's resolute mode of self-defence, — the bear himself finding out the plant that will heal his wound, and making and applying a plaster from it, — the wolf's cautious reasoning amid his hunger and voracity, — are instances of this sort. The wolf, with artful judgment, will take the babe from the mother's bed so gently as not to disturb her. Wolves also resolutely coöperate in their fatal attacks. To know the names which have been given to them by their owners, and to come, when these are pronounced, to those who so call them, imply in animals memory, a connection of sounds with ideas and actions, and an obeying will. The attention of some to music, which we have already alluded to, has a claim to be called an intellectual sensibility. So has the impression which some receive from the menacing features of the human face. The actions of the elephant and of the dog, which resemble those of thinking intellect, are very striking; but are so familiarly known, and have been so often described, that we need only recommend them to notice as very instructive testimonies of the nature and operations of the animal mind. The orang-outangs, likewise, which come near to us in form, at times evince some faculties and actions so analogous to our own, as to be only distinguished by the insurpassable limitation which appears always attached

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to them. But all the Simia tribes are confined to their native inferiority to us, and to their discordances from us, inflexibly and unalterably, in their minds as in their bodies. No time, and no arts, and no habit, can convert the baboon figure, features, or skin, into the feminine face and form which we love, or into the manly presence and body we admire; nor his imperfect mind into our capacities and sensibilities. What these tribes are they can only be for all succeeding ages in which they may exist. No brute animals of any kind, in any chronology of their being, have been found to possess the expanding and increasing improvability of the human soul. It is this quality, never extinguished or extinguishable, though often dormant, which proclaims our spirit to be born for immortality; as the want of it makes it probable that their vital principle in all other material organizations, at least in their present forms and phenomena, is not intended to be perpetuated hereafter.

General Remarks on Reptiles. — The Creator has made nothing that is unuseful, nothing so insulated as to have no relations with any thing else, — nothing which is not serviceable or instrumental to other purposes besides its own existence, — nothing that is not to be applicable or convertible to the benefit of his sentient creatures, in some respect or other. The mineral has a connection of this sort with both the vegetable and animal kingdoms, and these with each other. The same principle has been pursued throughout the animated classes of nature. No one species of living being has been formed only for itself, or can subsist in absolute uselessness to others. This is one grand

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purpose for causing so many races of animal being to subsist on each other. By this system, each enjoys the gift of life, and each is made to contribute, by the termination of that gift, to the well-being of others. Fishes are thus useful to each other, to many birds, to some animals, and to man. Birds have their period of happiness for themselves, and are serviceable to others of their kind, and to man and to some quadrupeds, in their mode of death, instead of mouldering through corruption into their material dissolution. Quadrupeds have the same double use in their existence; their own enjoyment, and the benefit at their death to those of their own order, and to the birds and reptiles, worms and insects, that have been appointed to derive nutrition from their substance. All the kingdoms of nature have been likewise so constructed as to be beneficial to the human race, not as nutriment only, but in the thousand conveniences to which they are convertible. Even the amphibious order of nature is no exception to these general results. Its various genera contribute their proportion to the common stock of mutual utilities. They have their own gratification from their personal existence; they contribute by their substance to the maintenance of others of their fellow-creatures; and some of their genera serve to multiply the conveniences and pleasures of man. He derives advantages from all that exists, in as much larger a degree to any other animal, as he is superior to any in his intellectual exertions and universal capacity.

The first order, the tortoise genera, are the most immediately serviceable to mankind. The flesh of

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the sea-turtle is both a valued delicacy and a useful medicine; and the shell of one species furnishes society with that rich and beautiful material which forms our tortoise-shell ornaments and conveniences. It is a gentle and harmless animal, without any means of hurting others. Its protecting shell forms both its house and its armor, and enables it to defend itself by a patient and passive resistance, without disturbing its natural mildness of temper.

The land-tortoise has the same gentle and peaceable manners. It can live without food, and probably does so, like many if not most of the fish, except at certain periods. It enjoys a great length of life, and has its living principle so essentially within its body, that it can subsist and move without either brain or head. This class of animals were thus made to be in the waters, what the sheep are on the hills and plains, —harmless, gentle, patient, and useful; one of the most pleasing forms of character of all animated being; the truest representative and surest producer of personal and social happiness.

Passing over the formidable crocodiles, and other species of lizards, only remarking that these, too, have their interesting qualities, we may notice the toad, generally regarded as one of the most repulsive forms of animal existence. Yet even specimens of these have been domesticated. One is known to have become familiar in a house for thirty-six years, and welcomed that light which, in its natural state, is offensive to it. It displayed here as much original mind as any other quadruped, and was never offensive. This fact is sufficient to show that the living principle of the toad

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race has the same susceptibility, memory, will, perception, suitable judgment, and limited improvability, as every class of animated nature seems to exhibit.

General Remarks on Birds. — A new system of exterior figure, and a new species of beauty, in the three main sources of the beautiful in material things, and to the surveying eye, — form, motion, and color, — arose to visible existence in the feathered creation. From the same causes of agreeable emotions, the fish excite pleasurable sensations in those who gaze upon their placid activity in the calm and clear ocean. And these feelings arise also within us as we handle the shells of the testacea, which are always so neat in figure, polish, hues, and completeness, and often impressively interesting in their most lovely tints and more elegant shapes; all announcing the refined taste and minute execution of their invisible Designer. But the birds eminently surpass all the marine classes in their appeals to our sense of beauty in their attractive appearance. Form, motion, finish, and color are the elements of what is beauteous in both orders of being; but the lovely and the pleasing emanate to us from the sprightly tenants of the trees and air with more interesting effect than from the inhabitants of the seas.

The plumage of birds is peculiar to their order of creation, and is always a pleasurable object both to sight and touch, and remarkable for the skill and delicacy of its composition and structure. In the equatorial regions it is more rich and splendid in its colors, yet always harmonizing in its most contrasted tints, and in its lights and shades. The effect is sometimes

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gorgeous, but never tawdry. In all its combinations and lustres it gratifies the cultivated taste, and, when extensively studied, enlarges the conceptions of the imagination by its elaborate diversity.

The birds of song abound in every known country; in the new continent as much as in the older or longer inhabited one. But as they are seldom found in the depth of the dense and damp forests of any climate, they are the more usual companions of civilized man. They frequent most the cleared and cultivated plains, as if by kind appointment to increase the number of human pleasures, by warbling their own feelings and happiness in those melodies which delight the human ear as much as themselves. Neither childhood nor manhood can hear them with indifference. Their notes are everywhere a large addition to human gratification, and become connected with the sweetest remembrances of the most joyous and impressible season of our life. They are usually small birds, and seem to be indestructible; for although cultivation, as it spreads, drives off many other species, yet by supplying these with more of the food they like best, they multiply from its abundance; and wherever gardens, fields, or trees appear, some classes of these rural musicians are sure to be part of their feathered inhabitants.

Birds are distinguished from all other animals by their power of supporting such a weight as their bodies in a medium so light as air; and from which, by the laws of gravity alone, they would fall downwards like a stone, the instant they left their twig. Here, the most special and scientific calculation, with a specific

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adaptation, become manifest to our consideration. No blind force or random power or motion could have here availed. A deliberating and knowing mind must have been their creator, combining what we term mathematical and mechanical science. The bodies of every species of birds differ in weight and bulk. But in order that they may fly, and remain suspended in the air while they do so, the motive energies of each must be precisely proportioned to the two things so very dissimilar, — to the gravity of his individual substance, and to the tenuity of the air through which he must glide and float. No general fitness would do; each distinct kind must have had alloted to it a different degree, peculiar to itself, and exactly adjusted to the spread of its own frame, and to its gravitating tendency. These suited proportions must not only have been discerned and appointed to every one at its creation, but, as earthly races are perpetuated from parents, the foreseeing Power had also to form and regulate the oval embryos of every species, so as that each should continually reproduce the same adapted fitness of motive force, weight, and bulk. Such a patient condescension of Almighty Power and Intelligence, deigning to apply so much thought and kind efficiency for the purpose of giving a multifarious variety to its creation, is far beyond our conception or panegyric.

Birds surpass all other animals in the faculty of continuing their motion without resting, as well as in its rapidity. The fleetest courser can scarcely ever run more than a mile in a minute, nor support that speed beyond five or six of such exertions. But the swallow does this for pleasure, for ten hours a day; and so can

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the blue-bird of America, for a space of six hundred miles, in the stages of his journey from Mexico to the territory of the United States. The passenger pigeons move with even greater celerity from one part of our continent to another. The golden eagle is supposed to dart through the fiercest storm at the rate of forty miles an hour; but one of our smallest birds, the swift, can even quadruple the most excited quickness of the race-horse for a distance, and therefore with a continuity of exertion hardly within the bounds of our reasonable belief.

One of the most special appointments of the Creator as to birds, and which nothing but his chosen design and corresponding ordainment can explain, is the law, that so many kinds shall migrate from one country to another, and most commonly at vast distances from each other. They might have been all framed to breed, be born, live, and die in the same region, as occurs to some, and as quadrupeds and insects do. But he has chosen to make them travel from one climate to another, with unerring precision, from an irresistible instinct, with a wonderful courage, with an untiring mobility, and in a right and never-failing direction. For this purpose, they cross oceans without fear, and with a persevering exertion that makes our most exhausting labors a comparative amusement. Philosophy in vain endeavours to account for the extraordinary phenomenon. It cannot discover any adequate physical reason. Warmer temperatures are not essentially necessary to incubation, nor always the object of the emigration; for the snow-bunting, though a bird of song, goes into the frozen

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zone to breed, lay, and nurture its young. The snow-bird has the same taste or constitution for the chilling weather, which the majority recede from. We can only resolve all these astonishing journeys into the appointment of the Creator, who has assigned to every bird the habits, as well as the form, which it was his good pleasure to imagine and to attach to it. The watchful naturalist may hear, if not see, several migrations of those birds which frequent our country, both to and fro, as spring advances and as autumn declines; but as they take place chiefly in the night or at an early dawn, and in the higher regions of the atmosphere, they are much oftener audible than visible to us on the surface of the earth.

The quantity of individuals of the various bird genera, which are at any one time and at all times existing in our world, surpasses not only our usual supposition, but even all power of human numeration, at least as to any real, distinct conception of the amount; for we can only pen down the words millions, billions, trillions, quadrillions, and such other augmentative terms, in which all actual comprehension soon becomes lost in mere verbal sounds and confusing obscurity.

The birds are a race of organized beings, as happy as they are beautiful: their greatest number are peaceful, friendly, social, innocent, and contented. The rapacious class, and some of the aquatic species, present a predatory anomaly; but the exuberant multitudes of their most prolific classes are of a kind, harmless, active, and neighbourly character. They seem to have a pleasure in being together in some mode or other.

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It is very interesting to observe the social and family feelings of many species. The rural naturalist has pleasingly described several instances of what resembles the conduct to which, among mankind, we annex the terms attachment and affection. Nor are these feelings confined to the milder birds. Even vultures are gregarious, and exhibit pleasure in each other's society.

To delineate the instincts, the feelings, and habits of the feathered kingdom is beyond our present limits. There is as much of what resembles intellectual sensibilities and reasoning, will, and judgment, in them, as in any genus of fish or quadrupeds. They seem to do all the things they ought; and to act with what may be called a steady common-sense in their respective situations. We have never seen a bird do a foolish thing, for a creature of their powers, frame, and organs, and in their state. Each acts with a uniform propriety; nothing fantastic, absurd, inconsistent, maniacal, or contradictory appears in their simple habits or daily conduct. They seem to have mental faculties and feelings like ours, up to a certain extent; but to that they are limited. They have not the universality, the diversifying capacity, nor the improvability of the human intellect. The bird mind is the same bird mind from generation to generation. The nightingale is now what the nightingale was four and six thousand years ago, — nothing less, nothing more. The eagle is as incapable of advancement as the sparrow. The common fowl, which is found in all regions and climates of the globe, is in each one exactly alike in its functions, faculties, and habits. The song-birds warble

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now just as they have done ever since human history has noticed them. It is this confining identity which separates birds and all animals so widely from man. They never improve; while his capability of progression is as yet illimitable, and may perhaps ever be so.

The bird mind, although limited, displays all the common faculties of animal intellect. Its memory is tenacious. The bulfinch never forgets the songs he has learned, though placed amid many others with different melodies. Most of the singing-birds may be taught the notes of others, and to pipe and whistle as their instructer pleases. Their aptness to acquire little acts of exhibition shows attention, comprehension, docility, and recollection. Some exhibit a taste for the little gratifications of human vanity; others, a spontaneous intellectual observation and perception of the intention of human actions. Even the highly mental emotion of emulation is visible among them. The perception that their eggs in hatching should have a proper degree of heat, and the alternate movement of them for that purpose, display both a right reasoning and acting rightly on it. Nor are they sometimes destitute of animal or human pugnacity. We expect this in the game birds that can be trained to it; but even the more gentle and peaceable can sometimes exert a petulant irritability. But it is in their nests that they display the most striking and varied indications of contriving and judging, and therefore of thinking intellect, confined, indeed, in the extent of its operations, but resembling reasoning intellect within this compass. Their affection for their young, their anxious contrivances to protect them, and little stratagems to mislead the ma-

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rauder from their nests, evince feelings and mental activities analogous to those of other reasoning beings.

REMARKS ON FISHES. — Fishes, like vegetables, are in several natural tribes, very distinguishable from each other, although all residing in the watery element; but this element, so uniform in its general qualities, has yet several peculiar divisions; as in rivers, lakes, marshes, and seas. Its greatest distinction is that of salt water in its oceanic diffusions, and of fresh water in its terrestrial distributions; and some of the fish are appropriated to each of these. It is, however, a prevailing opinion, that most, if not all, of the fresh-water fish originated in the sea; and it is certain that many which are inhabitants of the ocean pass from it into the rivers of the land, to breed and deposit their young; and these show themselves to be capable of living alternately in each.

Fishes have been made to differ in bulk, according to their species; and they are of all sizes and weights, from the minnow to the whale. After the latter, the shark takes the lead in dimensions, as it is from one to four thousand pounds in mass, and sometimes thirty feet long. Others are of great bulk without much length. But in their general nature, the other kinds are under a hundred pounds. Few reach fifty, and most are under twenty. In length, there are not many above twenty feet. Few attain ten feet. The largest number are less than three; and most, not even half that size.

The ocean pervades and surrounds the whole globe, and is so permeable to that projectile force which the fishes have been constructed to exert without fatigue,

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that these animals have facilities for rambling as they like which no others possess. But, notwithstanding their native power, several prefer particular localities. Some wander to great distances. Others are confined to inland seas and lakes. But the greater part move freely and variously through all the divisions of the oceanic diffusion, and especially those which sail in large shoals, or which seek the rivers or the shore to prepare and deposit their spawn.

Their reproductive system, analogous to that of plants by seeds, is oviparous in almost all; although some species, instead of eggs, bring forth their young alive. But the great majority lay their oval spawn; and some with a fecundity that equals the most marvellous abundance of vegetable sporules or semina.

It is the appointed law with many, that although among the general inhabitants of the sea, yet that they should be born in river-water; and that for this purpose their maternal parents should travel from the ocean to the fluvial streams of the land; and, forcing their way in opposition to the descending currents, glide upwards to such places as they select to be proper beds for their future progeny. The salmon is a remarkable instance of this selecting and persevering instinct. The salmon-trout, smelt, and shad, and several others, perform similar journeys. Others sail in vast shoals to the coasts of different countries for the same purpose of depositing their eggs along the suitable banks and shores. All are solicitous and careful to discharge them in the safest places that will promote their future vivification; but here their parental instinct ends: after this care they leave them to the

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other agencies of nature to mature. But the young fry need no further attention. At the proper time, varying in each species, they emerge from their oval abode, and immediately move about with great agility, and apparently in the full possession of their appointed faculties. Their wants are so few, and the supply so immediate, that as soon as they come into sentient being they have about them all that they require. They need no parental nutrition. A mother, in their element, could not do more for them than to provide a proper birthplace for them; and every maternal fish performs this office by moving to the right station with the instinctive accuracy which resembles selecting judgment.

Exclusive of figure, the largest number of the fish tribes are very agreeable objects to our sight; and many eminently beautiful in their colors, and in the general appearance of their neat and glossy skin and scales. Though dwelling in a watery medium, yet the marvellous light, from whose component rays all beauty of color and splendor proceed, often richly combines its adorning beams in their exterior surface; and emanates from them, by some inexplicable process, its softest and sweetest brilliance. Our commonest fish are often highly pleasing. Several have a golden hue, or spots, difficult to account for; and many, a silvery gloss, as though particles of these two metals were diffused among their skin. Others display a fine tinge of blue; some, very pleasing tints of green. Delicate gradations or diffusions of other colors make other species interesting to us. The effect of the whole is, that the general appearance of the fish creation, in their forms, colors, brilliancy, gliding movement, rapid and

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changeful activity, and universal animation and vigor, excites sentiments of pleasure and admiration in every reflecting mind that beholds them, in their free and spontaneous motions, in their native element. To us — with the exception of a few, principally the shark tribe — they are wholly inoffensive, as even sharks are in some places. None of them leave their element to attack us. Not many, even in their own domain, would molest us; but all, even the most hostile, remain there, helpless and indefensible against our power, however great their magnitude may be. All are at our mercy. The fiercest cannot long resist our means of annoyance. We kill and take what we please. None can either master or escape us. The divine command, that man "should have dominion over the fish of the sea," has been unceasingly fulfilled in all parts of the world, and in every generation, both of their races and of our own.

The general character of fish is not that of voracity and hostility. It is gentleness, harmlessness, sociality, and animation. They are peaceful animals; happy in themselves, and for the most part harmonizing together, without any general display of savage cruelty or malignant passions. Such as are appointed to be the food of others die in that way, and are sought and taken for that purpose, when the appetite actuates, but no further. But they cannot be justly stigmatized as voracious for this habit, more than ourselves for taking and eating them and cattle, sheep, fowls, and a multitude of other living creatures. We are carnivorous, but not voracious. We kill and cook the animals we feed on, but we have no malice, or ill-will, or hostility

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in such action or diet, any more than in plucking the apple, grinding the corn, or boiling the potato. It is therefore unjust to impute peculiar voracity and destructiveness to these tribes, because some feed on smaller fish, and others on the mollusca, worms, and insects that they find.

Fish are sensitive to pain and fear, and are also as susceptive of pleasurable feelings. They have the appearance of a placid and contented state of existence. No bird or quadruped seems happier. None have fewer wants. None require less means in order to be comfortable: they need only food; and yet they can subsist even without this when the abstinence is necessary. They suffer nothing from inclemency of weather, or variations of the seasons; nothing from heat, cold, frost, rain, or bitter winds. They seem to be generally exempted from disease. They are always in one even temperature; they enjoy a longer continuity of health and strength than most other animals; and from these causes appear to possess a natural longevity, which in some of their classes surpasses that of man. It seems to have been ascertained that even a carp may live for one or two centuries. Some have the comforts of family association; others, that of large mutual society. One kind has the gratification of suckling and nursing. Their sportiveness evidences their enjoyment; and their motion by swimming, being always governable as to its celerity by their own will, is gentle or rapid, just as they please; and must therefore be an exercise as pleasurable to them, as those of our own race who can imitate it find and declare it to be to human sensibility. Even their fear can subside when the reason for it ceases.

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That they possess and exercise volition we may prove by the two swordfishes who plunged their beaks into the ships they pursued, apparently supposing them to be whales, or some analogous substance, exhibiting a vigorous determination of their will to their own perdition. Yet, though mistaken in the object, the blow was not ill-judged, nor the force with which it was given; for this would have buried their snout so far in a whale as to have enabled them to have extracted the nutritive matter they sought by the action, before the whale could have loosened its wounded body from their attack. To mistake the keel of a vessel for the animal, was not a greater error than a seaman's mistaking a whale for an island, or a fog-bank for a real shore, which has been repeatedly done.

The fish which climbs trees displays an equal exertion of peculiar will, though its exact intention is not known, beyond the general idea that it is seeking for food, or something agreeable to its perception. The salmon exhibits a remarkable instance of determined effort to effect a rational purpose, in the extraordinary leaps which it makes to surmount cataracts or other obstacles which impede its progress as it ascends a river. This requires, not only will, but correct perception and judgment, as its muscular exertion must be regulated by the extent and nature of the hinderance which it meets with, and by a perception of the height to which its spring must reach. Other fish can make such elevating starts when they choose. The several species of flying-fish display, in like manner, voluntary exertions on emergencies of danger, in order to escape it; thus exhibiting a spontaneous motion for a reasona-

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ble purpose, at the proper moment, and continued as long as the necessity lasts, or the ability to perform it remains.

The periodical migrations of so many tribes, for the purpose of fecundating and depositing their eggs, display a mental instinct in rational, persevering, and efficacious operation. The same combination of action and judgment appears in the fish that crawls on land in search of water; and in the night journeys of eels, for obtaining food. But when they move with the semblance of following a conductor, in a marshalled form, we cannot avoid inferring in them the same degree of reasoned intention and judgment which we ascribe to other animals who exhibit such habits.

A distinct action of judging mind appears in the fish that directs the projectile blow on the insects it perceives, and desires to make its food; for this requires a careful proportioning of the force to the distance, and to the amount of the water that is thrown; in this operation an accurate perception and instantaneous judgment are necessary in order to produce so continually a successful result.

The fishes that hide themselves in the mud, to be in safety from their assailants, or to avoid danger, or to procure comfort, evince what resembles a perception and use of the fittest means to effect their wishes. The salmon, when storms come on, sinks to the bottom, as if with a right judgment to avoid what would injure it; while those to whom the agitation will be rather pleasurable than pernicious, become sensible of the impending change, and rise to the surface of its lake or stream as it approaches. All these, and many

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others we might relate, are actions for reasonable purposes, very similar to what all right judgment would do under such circumstances.

Such are the fish creation, — a race of beings both feeling and thinking, in that particular structure of body and residentiary element to which they were assigned. Like the vegetable tribes, they have been made to be useful to man, both in contributing to his sustenance and in supplying him with many important conveniences. But, independently of the human race, they have been created to be happy beings in themselves. From their vast numbers and varieties, and the comparatively small knowledge which man has of them, and the few out of their numerous species which have been converted to his use, we may assume that they were made principally on their own account, and for the display to us of our Creator's mind, power, thoughts, inventions, and imagination. They enlarge our knowledge of his omnipotence, and give us ocular sensations of its multifarious potentiality.

Of other Orders of Animals. — Our space is too limited to permit us to enter into details respecting serpents, whose variety, power, and qualities may well excite our admiration; nor can we do more than mention the crustaceous and molluscous races, which teem in the waters of the globe. The insect tribes, perhaps, excite the wonder of the naturalist even more than any other order of animals, yet these must be passed by with a few brief remarks.

The metamorphoses of insects are their most characterizing peculiarity. In these we certainly behold three distinct animals, as dissimilar from each other, in some

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genera, as the bird is from the serpent and the shell-fish, and yet united into one and the same living being by the personal identity of their principle of life. This only continues permanent and abiding through their triple change of material form. The bodily substance undergoes the most striking mutations; but the existing and feeling self remains unceasing and unaltered through all. The same animal crawls in its caterpillar shape; rests or sleeps in its torpid chrysalis; and springs from earth into air, with its new wings, its proboscis, and its antennæ, in its butterfly or moth configuration. What a stupendous wonder this magical transformation would be to us, if it were not so familiar. There is no reason to doubt that all the parts of the butterfly are in the caterpillar; as those of the human being are in the oval embryo. The material mechanism, the specific organization, is all ready and arranged; though not at first discernible, from its invisible minuteness. Gradually, this hidden form increases into an object of sight; every limb and function enlarging in just and progressive proportion; until the complete figure, so exactly beforehand conceived, assigned, and provided, grows into its last perfection, and emerges like a new creation, into its aerial and beautiful vivacity.

It seems like a resurrection from the tomb into a fresh life, with celestial destinations. It is so analagous to that which the human spirit is appointed to undergo, that the intellect cannot well avoid viewing the insect transformation as the emblem, the token, the natural herald and promise of our own. The ancients, without our Christian revelation, thought so; for one of their most pleasing imaginations, yet visible

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on some of their gravestones which we dig up, is that of a butterfly over the name or the inscription which they record. They place the insect there as the representation of their Psyche, — of the animating and surviving soul, — as the intimation that it will reappear in a new form and region of being. The allusion and the applicability are so striking, that we cannot but believe that one of the great purposes of the Deity in creating his insect kingdom was to excite this sentiment in the human heart; and to raise by it the contemplative mind to look forward to a possible revival from the tomb, as the butterfly from its sepulchral chrysalis. Like the insect, the human personality has three states, and changes, and forms of being, but continues indestructible through all. It emerges from its ovum into the figure and life of the present fleshy body; it rests in its earthly grave, unextinguished, though visible to mortal eye no longer; and it will emerge from that at the appointed time into its ethereal nature and immortalized capacities; always the same self in each transmutation; never dying or dissolving with its material investment; but surviving, to bloom in everlasting youth amid the most exquisite felicity, — the spiritualized butterfly, with angel wings, perhaps, and an imperishable vitality.

The fly passes through such changes to its winged state. So does the gnat, that annoys us, though always peculiarly alert in its own happiness. The beetle likewise. And such a transformation the little maggot, that we meet with in the nuts we open, undergoes if undisturbed. These successive states of insects, after the egg, are usually called the larva, the pupa, and

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the imago. Most, in the second, the pupa or chrysalis stage, never eat; but several species continue to move and feed.

Insects have the senses of other animals, though varying in their modifications and acuteness. Their hearing has been questioned; but it seems certain that some, at least, possess this faculty. A nervous system, analogous in matter and offices to the same substance wherever it exists, but in several respects differently organized and distributed, has been traced in their bodies.

That insects have spontaneous self-motion and free agency we continually see. They fly about as they please. They are not in a mechanical body, like a wooden or metallic automaton, made by human art, which has a certain number of springs that move its arm into as many determinate movements as these are provided to occasion, and no other. No fly comes in one straight, undeviating, or in one fixed, circular line, compelled to move only in that, and so to return; but we see that it can and does move in all directions, from its spontaneous impulses, and in all degrees of quickness or slowness, and comes and goes as it pleases. Every butterfly, gnat, or beetle does the same. No man has or exerts a more manifest, free, and self-originating agency, ever diversified, changeable, and unconstrained, than all winged insects display, wherever we see them.

We equally see the full and free exercise of individual choice and will. Try with any walking insect; it will move, not as you choose, but as it likes. Check it in one path, and, unless through fear it pauses,

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it will take another. It will not go in the course or to the point you wish, if left to itself, or without a positive compulsion.

They show us, that they have as clear and just a perception of external things as we have. The fly knows the treacle; the wasp, the sugar; the bee, his hive and honey; the caterpillar, the herb he likes, as well as we do. If driven away, they return to the thing they desire. The bee does not go to a leaf, instead of the flower; nor to a stone, instead of a tree. They perceive what they want to be the thing they want or like, and they move towards it accordingly. In this conduct they judge as rightly about it as we should do, and act as congruously towards it. The more we study the actions of insects with reference to their nature and purposes, we shall find that they habitually act with as much proper judgment concerning them, as our mind in their bodies would do.

If we were ants, or bees, what could we do better than what they do? The instances of wasps and others reducing the weight or shape of their prey, to enable them to carry it, are instances of both reasoning and judgment. So is that of the beetles' undermining the stake, to get at the toad, which it held above their reach. So is that of the humblebees' piercing the side of the calyx, to get at the honey, when they cannot reach the nectarium by going within it. No human parent could exert more reasoning and affectionate foresight for the benefit of the child that was about to be born, than another species of bee uniformly displays. The earwig appears to hatch her eggs with the maternal assiduity of the hen, and to allow no op-

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posing interposition to frustrate her intention. To assist a fellow-creature with the coöperation of our labor, when it is needed, is an act both of an observing and meaning mind, and of a benevolent feeling; and such an operation is performed by the pillchafers. It is a curious instance of the analogy which the creation has spread through all her races of animal being, as if to manifest that one Maker's mind and agency have fabricated all things, that some insects appear to have the faculty and habit of the nutritive rumination. Their discernment of the best place to be in for their transformation from their caterpillar state, and intentional motion on purpose to put themselves in it, has all the semblance of perceiving and judging mind. It is not resolvable into mere external impulse. It seems to arise from the animal's own will and determination on its sensations and necessities.

There seem to be reasonable grounds to infer that insects communicate their ideas and wishes to each other; and that ants perceive what another needs, and voluntarily assist him to attain his end. Dr. Franklin inferred such a communication between this class of insects, from a fact of his own observation. That insects have excitable passions, and can be irritated by mutual provocation to personal battle which they do not naturally seek, the Chinese have discovered, and inhumanly made the fact instrumental to their own amusement.

The muscular powers of insects are still more superior to those of the greatest animals than their comparative minds. Some amusing representations have been given of this difference. They have also another

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peculiarity, unequalled, and not possessed by any bird or quadruped. They can reproduce the limbs they may lose. Their diffusibility is also extraordinary, and in some species rivals that of plants. Hence, they may occasionally appear in the most distant countries, where before they were unknown. Such is their vitality that they can also live in the heat and confinement of the human stomach. As some fish and squirrels can fly, so there is a species of spider which have the power of floating or moving in air. But creation is full of analogies, pointing to one general Originator, and linking all sentient things into one great family of related fellow-creatures.

OF THE PHYSICAL CHARACTER OF MAN. — The bones, muscles, blood, arteries, veins, nerves, and brain of the human frame, — its breathing, digestive, nutritive, and circulating systems, — its sensorial organs, and its movable legs, — its desire and need of food, — and its sensual appetites and passions, — are all similar or nearly so to those of most quadrupeds, and are shared by us in common, more or less, with all animated nature. In these we are like other animals, and they are like us, — in these resemblances we are so nearly related, that if we were to be judged by a superficial view of our bodily structure alone, the brute and the man would be thought to differ more in figure than in nature, and might seem to be in more fraternal kinship than is usually admitted.

And yet, if more closely compared, the human body is found to have some peculiarities, which, even exclusive of its unequalled soul, attach to man a decided

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and permanent distinction and superiority, which no order of animals can rival, imitate, or acquire. Of these it will be sufficient to particularize four differences, which are quite enough to confer on our species the power of subduing, transcending, and governing every other class and kingdom of terrestrial nature.

The first is the erect structure, which both Ovid and Cicero remarked and panegyrized. All other animals are so framed in their bodily construction as not to possess this beauty and this advantage. They are made to be prone, with the exception of the Simia tribe; and they cannot raise themselves on their hind feet without pain, awkwardness, and inefficiency for any continuance. And though the ape and baboon class have more power of supporting an erect posture, yet they cannot do it with the facility, activity, strength, energy, and natural ability of man, and do not appear to derive any benefit from it over their fellow-brutes. But in the human race this erect stature is the foundation of their dominion and superiority over all the rest of the animal world.

The second peculiarity is the bony, muscular, and ligamentary structure of the human legs and feet, which give to his body, in its erect posture, a solidity of support, united with an agility, facility, and variety of movement, that no other animal possesses in equal applicability or effective power. By his legs and feet, man is fitted for every kind of motion, except that of flying; and though some quadrupeds excel him in temporary speed, none can vie with him in his universality and diversity of locomotion, nor in his power of continuing it. A man cannot outrun a horse for a limited

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distance, but in a protracted journey will frequently walk him down.

The third and chief distinguishing superiority which we shall notice is the human arm, with its hand and fingers. This is indeed the sceptre of his power, — his instrument of domination, — his all-conquering and all-transcending mechanism. It has all the potentiality of an enchanter's rod, and has achieved those wonders of human art, strength, and ingenuity, which the magicians of our imagination might toil in vain to surpass. We have not the eagle's talons or the lion's claws at the end of our fingers; but we can arm them with swords, guns, and bayonets, far more terrible. All that we admire and dread, and use in mechanism and manufacture, — in art, war, luxury, labor, and comfort, — is the produce of the human hand. Anatomy will explain the minute and scientific formation and arrangement of our bones, and their articulations in this limb; and of the muscles and ligaments which move them, in such instantaneous obedience to our thought and will.

The fourth great dissimilarity which may be remarked, and which is more immediately connected with our intellect, our sympathies, and our sensibilities, is the beautiful and delicate skin of the human body. Hasty and splenetic men have inveighed against Providence for sending us into the world so naked of all covering, — so destitute of natural clothing, — so exposed to all injuries and sufferings of temperature and wet, — while other animals have feathered, woolly, hairy, horny, shelly, or leathery outsides. Grumbling imbecility! Would any such querulous declaimers exchange their admirable skin for the hide of a beast,

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the scales of a crocodile, or the feathers of a turkey? Could any mind that sees, feels, or reasons, desire to have the physiognomy of a horse, an eagle, a lion, or an elephant, instead of the human face divine, — instead of its lovely complexion, its eloquent features, its attractive delicacy, and its impressive dignity? But, independent of all beauty, and of all that delights the eye, the taste, and the touch, in the human skin, who would relinquish the mental advantages which we derive from its exquisite nervous sensitivity? We could not have a large portion of our sensations and ideas without it. It is the delicate sensibility of the ends and inside of our fingers, and of our palm, which provides us with an important part of our most useful knowledge. The connection is unceasing between our mind and its delicate skin. A fine nervous expansion, proceeding from the brain, is purposely spread over the outside of our bodies, immediately under the last cuticle. That our intellect may have the benefit of this universal sensitivity, it is materially associated with our moral feelings and with our best sympathies. No small portion of the tenderness of our nature, and of our compassionate benevolences, are related to it. With the hide of a rhinoceros, or the wool of a sheep, or the shaggy coat of a bear, we should not possess the feelings of a human heart, nor the intellectual sensibility of a cultivated mind. A comparative stupidity, hardness of nature, insensibility, roughness, cruelty, or savage humor, would characterize us in such a transformation, as corresponding qualities accompany other creatures, according as their outside habiliment differs from our beautiful exterior.

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MISCELLANEOUS NOTES ON MAN. — *Origin of the different Races.* — This subject has been much discussed, and many theories have been adopted. The general conclusion among scientific men, as deduced from a large survey of facts, is, that they all originated from one source. Some of the reasons for this conclusion are as follows.

In the first place, we see among the same race great diversities. Thus, among the inhabitants of Hindostan, known to be of one descent, there are groups of people of almost all shades of color, and of great diversity of features. In Africa, there are negro nations of intensely black complexion, such as the Jolofs, Mandingoes, and Kafirs, whose features and limbs are as elegant as those of the best European nations. Now, if we infer from the differences we discover in the five great races a difference of origin, must we not also suppose that the diversities we find among members of the same nation must also be the result of a difference of origin? Such a supposition runs us at once into absurdity. It is therefore more rational to conclude, that the same causes that create diversity in the physical characteristics of a nation, operating for a longer period, and under particular circumstances with greater force, upon the human family, may have produced all the diversities which are found among mankind.

It would seem that nature herself has provided for diversifying the characteristics of the human race, even in the birth. True whites have been born among the negroes, and the tendency to this singularity is transmitted in families. There is an authentic instance of a

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set of perfectly black children being born to an Arab couple, in whose ancestry no such blood had intermingled. Many similar instances have occurred.

The style of living is ascertained to have a powerful effect in modifying the human figure in the course of generations, and this even in its osseous structure. About two hundred years ago, a number of people were driven, by a barbarous policy, from the counties of Antrim and Down, in Ireland, towards the sea-coast, where they have ever since been settled, but in unusually miserable circumstances even for Ireland; and the consequence is that they exhibit peculiar features of the most repulsive kind, — projecting jaws, with large, open mouths, depressed noses, high cheek-bones, and bow legs, together with an extremely diminutive stature. These, with an abnormal slenderness of the limbs, are the outward marks of a low and barbarous condition all over the world; it is particularly seen in the Australian aborigines.

"Coarse, unwholesome, and ill-prepared food," says Buffon, "makes the human race depreciate. All those people who live miserably are ugly and ill-made. Even in France, the country people are not so beautiful as those who live in towns; and I have often remarked, that in those villages where the people are richer and better fed, the men are likewise more handsome, and have better countenances." He might have added, that elegant and commodious dwellings, cleanly habits, comfortable clothing, and being exposed to the open air only as much as health requires, coöperate with food in increasing the elegance of a race of human beings.

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Climate is known to have great influence in changing the physical character of man. Dr. Dwight says: — "The change of the blacks whose ancestors were introduced into New England is already very great, as to their shape, features, hair, and complexion. Within the last thirty years, I have not seen a single person of African descent who was not many shades whiter than the blacks formerly imported directly from Guinea." The same writer tells us of an Indian who became entirely white, his skin appearing perfectly smooth, fresh, and delicate. He also informs us that he saw a negro, named Henry Moss, born in Virginia, whose hair was originally woolly and black; this person became white, and had a clear and fresh complexion; his hair also became of a flaxen hue, and perfectly free from curling.

These and similar facts would seem to be sufficient to lead to the conclusion, that the varieties of the human race have sprung from the influence of circumstances, and the provisions of nature which tend to the same point.

Age of Man. — Children die in large proportions, because their diseases cannot be explained, and because the organs are not habituated to the functions of life. Half die before twenty-six, and two thirds before fifty. The mean of life varies in different countries from forty to forty-five. A generation from father to son is about thirty years. The mean succession of kings is about twenty-two years, less than a generation, because they often suffer violent deaths, or destroy themselves by vice and indulgence. Of men in general, five sixths die before seventy, and fifteen

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sixteenths before eighty. After eighty it is rather endurance than enjoyment. The nerves are blunted, the senses fail, the muscles are rigid; the softer tubes become hard, the memory fails, the brain ossifies, the affections are buried, and hope ceases. The remaining sixteenth die at eighty, exceping the hundred and thirty-third part, at ninety. A remainder die, from inability to live, at or before one hundred.

In Russia, much more than in any other country, instances of longevity are numerous, if the accounts are true. In the report of the Holy Synod in 1827, during the year 1825, and only among the Greek religion, 848 men had reached upwards of 100 years of age; 32 had passed their 120th year; 4 were from 130 to 135. Out of 606,818 men, who died in 1826, 2,785 were above 90; 1,432 above 95; and 818 above 100 years of age. Among this last number, 88 were above 115; 24 more than 120; 7 about 125; and one, 160.

Riley asserts that Arabs, in the desert, live two hundred years, but this may be doubted. "Old Parr," in England, died in 1635, aged 152 years. Henry Jenkins, of Bolton, Yorkshire, was the oldest man known in modern times. He died in 1670, aged 169.

The black races on the African coast are short-lived, and old at forty-five. In the plains of the interior, many live to one hundred. Slaves in the West Indies are mentioned as from 130 to 150 years of age. Burchell mentions Hottentots near one hundred.

About the age of thirty-six, the lean man becomes fat, and the fat man lean. Again, between the years forty-three and fifty, his appetite fails, his complexion

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fades, and his tongue is apt to be furred upon the least exertion of body or mind. At this period his muscles become flabby, his joints weak, his spirits droop, and his sleep is imperfect and unrefreshing. After suffering under these complaints a year, or perhaps two, he starts afresh with renewed vigor, and goes on to sixty-one or two, when a similar change takes place, but with aggravated symptoms. When these grand periods have been successively passed, the gravity of incumbent years is more strongly marked, and he begins to boast of his age.

The grand climacteric in human life varies between sixty and seventy, and was anciently an astrological period, which depended on the revolutions of Jupiter and Saturn, five of one and two of the other.

Stature of Man. — Quetelet and others have attentively examined the relative heights of individuals of *single* nations, at different ages, with a view to determine the general phenomena of man's growth; but few observations have been made upon the respective heights of different races or nations. The stature of the Caucasian has not been fully compared with that of the Mongol, or the Negro, or the red Indian; nor have single nations, belonging to any of these great varieties, been satisfactorily contrasted with one another, as respects height. No accurate comparisons, for example, have yet been made of German with Spaniard, of Briton with Frenchman, or, in fact, of any one European nation with another. The following table, exhibiting the comparative heights of a small number of Englishmen and negroes, is given in the work of Mr. Lawrence upon the natural history of man. The negroes were from various regions.

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	Stature. Feet.	In.		Stature. Feet.	In.
An Englishman,	6	4½	A Negro,	5	10½
do.	6	1	do.	5	5½
do.	6	0	do.	5	8
do.	5	9½	do.	5	0
do.	5	7	do.	5	7½
do.	5	4½			
do.	5	0			

The Caucasian here has considerably the advantage of the negro, the average height of the former class being nearly five feet nine inches, while the black averages little above five feet six inches; and the advantage would still be on the same side were we to leave the first Englishman, certainly a man of uncommon height, entirely out of the reckoning. But it must be admitted, that from such an insignificant amount of examples no satisfactory conclusions can be drawn.

Professor Forbes of Edinburgh has recently made a series of experiments upon the physical differences between English, Scotch, Irish, and Belgians, the results of which constitute the most interesting information we are able to lay before the reader with respect to the comparative heights of sub-varieties of the Caucasians. The following is a table drawn up by Professor Forbes, to exhibit the relative heights, at different ages, of the students attending his class, during a series of years, and belonging respectively to England, Scotland, and Ireland. The Belgian measurements were probably derived from other sources. The number of individuals subjected to examination was very

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considerable, so many as eighty Scotch and thirty English being occasionally measured at once.

Heights (full dimensions, with shoes).

Age.	English.	Scotch.	Irish.	Belgians.
	Inches.	Inches.	Inches.	Inches.
15	64·4	64·7	...	61·8
16	66·5	66·8	...	64·2
17	67·5	67·9	...	66·1
18	68·1	68·5	68·7	67·2
19	68·5	68·9	69·4	67·7
20	68·7	69·1	69·8	67·9
21	68·8	69·2	70·0	68·0
22	68·9	69·2	70·1	68·1
23	68·9	69·3	70·2	68·2
24	68·9	69·3	70·2	68·2
25	68·9	69·3	70·2	68·3

This table places the Irishman uppermost in the scale of stature, the Scotsman second, the Englishman next, and the Belgian lowest. The comparison seems to be fair as regards the parties taken.

The belief of the existence of races of giants seems to be sustained by the Bible and Sanconiathon. There are sometimes men, seven, eight, or nine feet high; and, among savage tribes, this adds to their ascendency, and assures the rank of chief. All buildings, door-ways, passages, &c., indicate, however, that five feet eight inches, or five feet nine inches, has always been the average height of the human race. The book of Genesis speaks of "sons of Gad," who were giants; of the men of Anak, to whom the Jews were as grasshoppers; and the Bible elsewhere

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tells us of Og, king of Bashan, who was thirteen and one fourth feet high, and Goliath, eleven feet! There are also other testimonies to the general fact, that there were, in early times, tribes of men of very large stature; and there is nothing in this incompatible with the theory that the common standard has always been the same as now.

The Esquimaux and Bosjesmen attain but four feet three inches, and the Mongol Tartars and Kamtschadales but four feet nine inches. The Caribs are five feet eleven inches; the Navigators' Islanders, five feet six inches; and the Patagonians, six feet seven inches and upwards. It appears to be a general law, that man dwindles in size in the inhospitable polar regions.

Weight of Man. — The average weight of the male infant at birth is seven pounds avoirdupois; that of the female is not quite six and a quarter. The maximum weight — one hundred and forty pounds — of the male is attained at the age of forty; that of the female — nearly one hundred and twenty-four pounds — is not attained till fifty; from which ages they decline afterwards, the male to a hundred and twenty-seven pounds, the female to a hundred and nine pounds. The full-grown adult is twenty times as heavy as a new-born infant. In the first year, the child triples his weight; afterwards, the growth proceeds in geometrical progression. At an equality of age, the male is generally heavier than the female; towards the age of twelve years only, an individual of each sex has the same weight.

The stature, weight, and strength of the human body form but parts of one and the same subject.

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Each of these properties or characteristics, if not dependent on, is at least closely related to, both the others. In all undertakings that require the exertion of physical energy, and more particularly in war, bodily weight, it has now been clearly shown, is a most important element; and, wherever the superiority in this respect lies, thither will success, other circumstances being equal, almost infallibly tend. An observation of the various collisions of troops on the field of Waterloo, whether of horse or foot, has been found to substantiate this proposition.

Professor Forbes extended his inquiries among his students, English, Scotch, and Irish, to bodily weight, adding examinations of similar, and also of mixed, classes of Belgians. The results were as follow: —

Weight in Pounds, including Clothes.

Age.	English.	Scotch.	Irish.	Belgians (not mixed classes).
	lbs.	lbs.	lbs.	lbs.
15	114.5	112	...	102
16	127	125.5	129	117.5
17	133.5	133.5	136	127
18	138	139	141.5	134
19	141	143	145.5	139.5
20	144	146.5	142	143
21	146	142.5	151	145.5
22	147.5	150	153	147
23	149	151	154	148.5
24	150	152	155	149.5
25	151	152.5	155	150

Strength of Man. — Observing the extraordinary displays of physical power and energy frequently made

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by savages, scientific men were long of opinion that civilization diminished the strength of the human frame. Other circumstances tended to foster this belief. The negro is possessed of longer arms, or at least fore-arms, than the Caucasian, holding in this respect, it is worthy of remark, a middle place between the white and the ape, which latter creature has arms of great length. "I measured," says Mr. White, "the arms of about fifty negroes, men, women, and children, born in very different climes, and found the lower arm longer than in Europeans, in proportion to the upper arm and height of the body." The same writer says that whites of six feet four inches, whom he measured, had shorter arms than negroes of middle size. Similar sources of physical superiority appeared to voyagers to be possessed by the Pacific Islanders, the Malays, and many other uncultivated races. But more attentive observation has disproved the supposition. The voyager Peron took with him to the southern hemisphere a dynamometer, with which he experimented on the following number of individuals: twelve natives of Van Diemen's Land, seventeen of New Holland, fifty-six of the island of Timor, — a fine race of men, — seventeen Frenchmen, and fourteen Englishmen. The following numbers express the mean result in each case, the strength of the arms and loins being respectively put to the test. It is by lifting a weight that the strength of the loins is tested with the dynamometer.

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Mean Strength.

	Arms. Kilogrammes.	Loins. Myriogrammes.
1. Van Diemen natives, -	50.6	...
2. New Hollanders, - -	50.8	10.2
3. Timorians, - -	58.7	11.6
4. Frenchmen, - - -	69.2	15.2
5. Englishmen, - -	71.4	16.3

The highest power of arm shown by any of the Van Diemen natives was 60; by the New Hollanders, 62; while the lowest in the English trials was 63, and the highest 83. In *lumbar* power, or that of the loins, the highest point reached by a New Hollander was 13; the lowest of the English was 12.7, and the highest 21.3.

"These results," says Mr. Lawrence, "offer the best answer to the declamations on the degeneracy of man. The attribute of superior strength, so boldly assumed by the eulogists of the savage state, has never been questioned or doubted. Although we have been consoled for this inferiority by an enumeration of the many precious benefits derived from civilization, it has always been felt as a somewhat degrading disadvantage. Bodily strength is a concomitant of good health, which is produced and supported by a regular supply of wholesome and nutritious food, and by active occupation. The industrious and well-fed middle classes of a civilized community may be reasonably expected to surpass, in this endowment, the miserable savages, who are never well fed, and too frequently depressed by absolute want and all other privations."

Proper and extended comparisons are yet to be made

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of the relative physical power of the various Caucasian nations. The following table of Professor Forbes gives us at least a glimpse at the comparative strengths of English, Scotch, Irish, and Belgians: —

Lumbar Strength in Pounds.

Age.	English.	Scotch.	Irish.	Belgians.
15	...	280	...	204
16	336	314	...	236
17	352	340	369	260
18	364	360	389	280
19	378	378	404	296
20	385	392	416	310
21	392	402	423	322
22	397	410	427	330
23	401	417	430	335
24	402	421	431	337
25	403	423	432	339

The difference in lumbar strength between men and women is remarkable, as shown in Quetelet's table. At the age of twenty-five, when both attain the maximum of lumbar strength, the woman is deficient by more than one half.

Mental Power of Man.—It is only a recapitulation of what has been often stated to say, that great differences of mental character are exhibited by the various races of mankind. The black intertropical nations generally are decidedly the lowest in the intellectual scale. They are commonly characterized by great indolence, as well as by gross barbarism and superstition. The idea of a social community has made but a small advance amongst them, though more amongst

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some tribes than others. The lowest of the class are to be found in Australia and some of the islands of the Pacific. Yet there is scarcely any tribe of blacks so mean, but they possess certain traits of mind calculated to produce respect, being in some instances surprisingly ingenious in fabricating particular articles, or in the management of canoes and the use of warlike implements.

The red races of North America are a considerably superior race to the negroes. Their associations for war and other purposes are upon a more complicated scale; they show many remarkable traits of ingenuity; and certain tribes have, at some periods, made great progress in civilization.

The Mongolians, and the Indian branch of the Caucasians, must be considered next in the scale. They have formed great states, and made advances in the arts and in science; but a stationary character appears to be impressed on them all, and ages pass without their manifesting the slightest moral or political improvement. The Malayan variety exhibits a somewhat inferior character to the Mongolians, but not so different as to call for special notice.

The Caucasian variety, as a whole, stands greatly above all the rest. It is characterized by superior sagacity and sentiment, and, above all, by a progressive character which other races have only shown in a very limited degree. The social arrangements formed by some branches of this race are the most calculated to insure the general happiness which have ever been known. Their industry and perseverance, aided by the lights which they have deduced from science, have

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led to the production of an amount of wealth beyond the dreams of Orientals. Their benevolence has caused them not only to found institutions calculated to succour the poor and afflicted in their own country, but to exert themselves for the benefit of other nations in every region of the globe. Wherever this race sets its foot, it makes itself master, — a result directly flowing from its superior energy, skill, and perseverance. Amongst the branches of the Caucasian variety, considerable differences prevail. The Indian branch approaches to the Mongolian variety, and it is in the Pelasgian branch in ancient, and the Teutonic or German in modern times, that we find the utmost development of the finest faculties of the species.

Whatever may be thought of the phrenological doctrine in its details, it is at least scarcely possible to dissent from the moderate conclusion of Dr. Prichard, that "fully developed brains indicate great intellect." Hence, leaving out of the question the connection of the development of the skull with that of the facial bones, the simple *capacity* of the cerebral case becomes in itself a matter of the highest consequence. We happily have it in our power, from the experiments of a most accurate inquirer, Professor Morton, to determine the comparative capacity of the skulls of all the varieties of mankind.

Having obtained a considerable number of the skulls of the various races of men, Dr. Morton measured their internal capacity by means of white pepper seed, and found the following results: —

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Races.	No. of skulls.	Mean capacity in cubic in.	Largest in the series.	Smallest in the series.
1. Caucasian,	52	87	109	75
2. Mongolian,	10	83	93	69
3. Malay,	18	81	89	64
4. Aboriginal American	147	80	100	60
5. Ethiopian,	29	78	94	65

It thus appears that the aboriginal Americans rank fourth with respect to the size of their brains, the Ethiopians being lowest, and the Caucasians highest.

This result is certainly the precise one to be expected, considering the capacity of the cranium as an index of intellectual power. The Caucasian race, which stands highest in the scale, is that which has produced the most civilized nations; while the Mongolian, the next in order of capacity of cranium, has produced a number of nations which remain at a fixed point in semi-civilization. The Malay is a degree more barbarous, and the American and Ethiopian the most barbarous of all. We shall hereafter more particularly notice the division of the human family into distinct races.

Population. — There has been great diversity in the estimates of different persons as to the population of the globe. The following, from "The Weimar Almanac," is a medium calculation.

	Population.	Extent.	Pop. per sq. mile.
Europe,	221,906,000	3,134,652	61
Asia,	461,196,000	17,238,188	26.7
Africa,	107,615,000	10,787,063	9.9
America,	42,164,000	14,755,006	2.8
Oceanica,	2,695,000	3,347,840	0.8
Total,	835,578,000	49,263,448	16.9

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"Every generation is a direct product of the *marriages* in the preceding generation; that is, the number of the existing generation, of all ages, is the product of the number of all the marriages in the past generation by the average number of children, 3.7 or 3.8, produced by a marriage. Therefore, the number of marriages in any year, by the ratio of children, is the number for every year of the next generation; and this annual number into the years in a generation is the whole population of the next generation."

"The population of the globe," says Sir Richard Phillips, "for the last century was estimated at one thousand millions, but modern calculators reduce it to about eight hundred. If a doubling took place every twenty-five years, according to an absurd theory, the population in 1800 could have been but three hundred millions; in 1775, but one hundred and fifty millions; in 1750, but seventy-five millions; and in 1700, but eighteen and three-fourths millions; in the reign of Charles the Second, but nine and seven-eighths millions, and in the time of James the First, even when public writers estimated the population at one thousand millions, there ought only to have been Adam and Eve in Moses' paradise. Comparing deaths with births, doubling, under favorable circumstances, really takes place in only about two hundred and sixty years. But it may be doubted, whether, in the aggregate, the earth was not as populous in the days of Augustus as at present."

Taking the population of the globe at eight hundred and fifty millions, and supposing a generation to contain thirty years, which is the usual estimate, it appears

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that 26,666,666 persons are born every year, and of course the same number die every year; 73,059 die, and 73,059 are born every day; 51 die every minute, and 51 are born every minute; and nearly one dies and is born every second!

If we suppose the average population of the globe to have been half what it is now, from the creation, six thousand years ago, to the present time, the number that have lived is eighty billions!

Phillips makes the following curious calculation: — "In regard to the physical bulk of the contemporary population, — since nine middle-sized persons can stand within a square yard, so a single square mile of 3,097,600 square yards, or 27,878,400 feet, would hold a greater number than the population of Great Britain! And if there are thirty six times this number on the globe, the whole would occupy an area but six miles each way! Then, as there are fifty millions of square miles of land, — 8,333,333 times six miles, — so two hundred generations of men reduced to dust, and pressed to the density of soil, would be but eighteen inches of coating to the thirty-six miles, and, of course, but the 450,000th of an inch scattered over the whole surface. But if a man's body is renewed fifty times during life, even then, it would form soil but the 9,000th of an inch; so that the species *homo* have afforded in reality but little manure to the earth's surface."

"If it be asked," says the same writer, "whether the human race, and the present system of animal economy will endure as long as the globe and its solar reactions, we have no data but references to the past. We see races, kinds, and forms, once covering the sur-

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face, now no more. We find ages of shelly beings, of reptiles, of pachyderma, of gigantic creatures, &c. We now find races reacting on an atmosphere as seventy-nine to twenty-one, and sustained by water eleven to seventy-nine. Will these proportions last? Does not oxygen increase and hasten life, and does not water dessiccate? We see the human race flowing from the exhausted East to the West, portentous of results when the tour is completed. We see species disappear, and behold every proof that the circle of existence resembles an endless spiral, changing forms at every deflection of its solemn course!"

So far as the preceding writer argues from the exhausted state of the old world, we need pay little regard to his inferences; but, when we reflect that human life depends upon an exact mixture of certain gases in the atmosphere, and that a slight alteration of these proportions would at once annihilate the whole human race, we can easily see that, without flood or fire, mankind may become extinct, at the slightest exercise of the Almighty's will. If it be true that the whole interior of the earth is a molten mass, as we have reason to believe, and if we further reflect upon the mighty revolutions which have taken place in the structure of the globe's surface, sometimes heaving up whole continents from the bed of the sea, and again drowning them in the fathomless brine of the ocean, we shall see that human destiny, for ages to come, is a subject upon which calculation is uncertain, if not vain. If, indeed, we may judge from the past, and consider the whole plan of Providence as far as we can read it, we may fairly conclude that the human race is but

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upon the threshold of its existence, and as we see them advancing in population, arts, knowledge, and happiness, we may cherish the belief that man in his future career is to cover the whole earth with science and civilization.

"Every individual," it is said, "has two parents; these have had four, the four have had eight; and so on in a geometrical series. Hence, it is not difficult to determine the comixture of families, in past and in future ages, taking every generation as forty years, or five generations in two centuries, or twenty-five in a thousand years. Two hundred years previously, or five generations ago, the ancestors of every living individual were 2^5, or 32 persons; four hundred years ago, 2^{10}, or 1,024; six hundred years ago, 2^{15}, or 32,768; eight hundred years ago, 2^{20}, or 1,050,000 nearly; one thousand years ago, 2^{25}, or 33,548,000. So that this series, in duplicate ratio, connects every living person in Britain with 1,050,000 in the age of Edward the Confessor, and with the whole population in the age of Alfred. And, as it is in looking backward, so it is as to futurity. In one thousand years hence, 33,548,000 will be the posterity of every living parent of every child who has children. The comixture may not be complete, but such is the tendency, and, in degree the effect."

Habitations of Man. — Man, born helpless, availed himself of his instincts and imitations of other animals to seek asylums in caves. Born with a naked skin, he found convenience in clothing himself in the skins of animals. By a transition, not yet complete as to large portions of his genus, he raised his caves above ground

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and became an architect; and, by combining fibrous materials, he became a manufacturer. His taste led him to adopt different styles of building, and his materials different fabrics. But, nevertheless, the varied progression proves that certain species had more genius and aptitude than others; and this soon led to different modes of life, which have tended to produce those varieties of complexion, form, and character, which we see in the different nations of the earth.

Food of Man. —It has been often contended, that man was made to eat only vegetable food, and that it is an abuse of his nature to take flesh. "You ask me," says Plutarch, "for what reason Pythagoras abstained from eating the flesh of brutes? For my part, I am astonished to think what appetite first induced man to taste of a dead carcass; or what motive could suggest the notion of nourishing himself with the putrefying flesh of dead animals."

"Nothing," says Pope, "can be more shocking or horrid than one of our kitchens, sprinkled with blood, and abounding with the cries of creatures expiring, or with the limbs of dead animals, scattered, or hung up, here and there. It gives one the image of a giant's den in romance, bestrewed with scattered heads and mangled limbs."

Notwithstanding these and other high authorities, the general conclusion is, that man was designed by his Creator to be omnivorous. All savage nations appear to have been cannibals in some stage of their progress. Diogenes asserted, that we might as well eat the flesh of men as the flesh of other animals. The Greeks inform us that it was a primitive and universal custom.

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Some of their gods lived on human flesh, and the Cyclops did the same. Aristotle and Herodotus name various nations who preferred human flesh to that of animals. The Giagas, and several African nations, have the same preference; and we remember the practices at Hawaii, New Zealand, &c. Human flesh has the flavor of hog's flesh and veal, and we have heard of a native Brazilian woman, converted by the Jesuit missionaries, who, when sick, could think of nothing she could eat but the fingers of a Tapuya boy! Voltaire says, that in 1725 he saw four savages from the Mississippi, one of whom, a female, admitted that she had eaten men; but contended that victors ought to have the preference over wild beasts. St. Jerome states, that he saw Scotchmen in the Roman armies in Gaul who fed on human flesh as a delicacy.

A female, who in 1829 was sixty-two years of age, and resided at Pynacre, near Delft, had, from disease, not eaten any thing since 1818, nor drank any thing since 1820. Total exhaustion was prevented by damp wrappers. Several instances have been known of persons who have lived without drink for several years. Total abstinence from food above seven days is generally fatal to man; but there are instances of surviving after a longer period. A religious fanatic, in 1789, determined to fast forty days, but died on the sixteenth.

In 1800, a French prisoner, at Liverpool, exhibited a most extraordinary propensity to devour nauseous diet, particularly cats, of which in one year he eat one hundred and seventy-four, many of them while alive.

An Esquimaux boy, supplied by Captain Parry, ate in one day ten and a quarter pounds of solid food, and

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drank of various liquids a gallon and a half. A man of the same nation ate ten pounds of solids, including two candles, and drank two gallons. Yet they were neither of them over four and a half feet high. A soldier, aged seventeen, named Tarare, ate twenty-four pounds of leg of beef in twenty-four hours, and, on another occasion, all the dinner prepared for fifteen.

Of all rapacious animals, says Smellie, man is the most universal destroyer. The destruction of carnivorous quadrupeds, birds, and insects, is in general limited to particular kinds. But the rapacity of man has hardly any limitation. His empire over the other animals which inhabit this globe is almost universal. Of some of the quadruped tribes, as the horse, the dog, and the cat, he makes domestic slaves; and though, in this country, none of these species are used for food, he either obliges them to labor for him, or keeps them as sources of pleasure and amusement. From other quadrupeds, as the ox, the sheep, and the goat, he derives innumerable advantages. The ox kind, in particular, after receiving the emoluments of their labor and fertility, he rewards with death, and then feeds upon their carcasses. Many other species, though not commonly used for food, are daily massacred by millions for the purposes of commerce, luxury, and caprice. Myriads of quadrupeds are annually destroyed for the sake of their furs, their hides, their odoriferous secretions, &c.

Over the feathered tribes the dominion of man is not less extensive. There are few species in the numerous and diversified class of birds which he either does not or may not employ for the nourishment of his body.

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By his sagacity and address he has been enabled to domesticate many of the more prolific and delicious species, as turkeys, geese, and the various kinds of poultry. These he multiplies without end, and devours at pleasure.

Neither do the inhabitants of the waters escape the rapacity of man. Rivers, lakes, and even the ocean itself, feel the power of his empire, and are forced to supply him with provisions. Neither air nor water can defend against the ingenuity, the art, and the destructive industry of the human species. Man may be said even to have domesticated some species. In artificial ponds, he feeds and rears carp, tench, perch, trout, and other species, and with them occasionally furnishes his table.

It might have been expected that insects and reptiles, some of which have a most disgusting aspect, could not have excited the human appetite. But we learn from experience, that, in every region of the earth, many insects, which inhabit both the earth and the waters, are esteemed as delicate articles of luxury. Even the viper, though its venom be deleterious, escapes not the all-devouring jaws of man.

Thus man holds and too often exercises a tyrannical dominion over almost the whole of the brute creation; not because he is the strongest of all animals, but because his intellect, though of a similar nature, is vastly superior to that of the most sagacious of the less favored tribes. He reigns over the other animals, because the powers of his mind are more extensive. He overcomes force by ingenuity, and swiftness by art and persevering industry. But the empire of man over the brute creation is not absolute. Some species elude

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his power by the rapidity of their flight, by the obscurity of their retreats, and by the element in which they live. Others escape him by the minuteness of their bodies; and, instead of acknowledging their sovereign, others boldly attack him with open hostility. He is also insulted and injured by the stings of insects and by the poisonous bites of serpents.

In other respects, man's empire, though comparatively great, is very much limited. He has no influence on the universe, on the motions and affections of the heavenly bodies, or on the revolution of the globe which he inhabits. Neither has he a general dominion over animals, vegetables, or minerals. His power reaches not species, but is confined to individuals. Every order of beings moves on in its course, perishes, or is renewed, by the irresistible power of nature. Even man himself, hurried along by the general torrent of time and of nature, cannot prolong his existence. He is obliged to submit to the universal law, and, like all other organized beings, he is born, grows to maturity, and dies.

Though man has been enabled to subdue the animal creation by the superior power of his mind, his empire, like all other empires, could not be firmly established previous to the institution of numerous societies. Almost the whole of his power is derived from society. It matures his reason, gives exertion to his genius, and unites his forces. Before the formation of large societies, man was, perhaps, the most helpless and the least formidable of all animals. Naked and destitute of arms, to him the earth was only an immense desert, peopled by strange and rapacious monsters, by whom

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he was often devoured. Even long after this period, history informs us that the first heroes were destroyers of wild beasts. But after the human species had multiplied and spread over the earth, and when, by means of society and the arts, man was enabled to conquer a considerable part of the globe, he forced the wild beasts gradually to retire to the deserts. He reduced the number of the voracious and noxious species. He opposed the powers and the dexterity of one animal to those of another. Some he subdued by address, and others by force. In this manner, he in process of time acquired to himself perfect security, and established an empire that has no other limits than inaccessible solitudes, burning sands, frozen mountains, or obscure caverns, which are occupied as retreats by a few species of ferocious animals.

Prodigies.— Sir Jeffrey Hudson, the dwarf, was but eighteen inches in height till the age of thirty, and then he rose to thirty-nine inches. Bebe, the Pole, was only thirty-two inches at his death, aged twenty-three, and slender in faculties. Boruwlaski * was only twenty-eight inches at twenty-two, yet a man of talents. General Tom Thumb, now living, is about twenty inches, at the age of thirteen. In Ava, a man was lately living, covered from head to foot with hair. The hair on the face was shaggy, and about eight inches long. On the breast and shoulders it was four to five. At Ava, he married a Burmese woman, by whom he had two daughters; the eldest resembled her

* For a life of Boruwlaski, and other dwarfs, see "Curiosities of Human Nature."

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mother, but the youngest was covered with hair like her father.

The foot of a Chinese female, from the heel to the great toe, measures only four inches; the great toe is bent abruptly backwards, and its extremity pointed directly upwards; while the phalanges of the other toes are doubled in beneath the sole of the foot, there being scarcely any breadth across the foot, where it is naturally broadest. The heel, instead of projecting backwards, descends in a straight line from the bones of the leg, and imparts a singular appearance to the foot, as if it were kept in a state of permanent extension. From the doubling in of the toes into the sole of the foot, the external edge of the foot is formed, in a great measure, by the extremities of the metatarsal bones; and a deep cleft or hollow appears in the soles.

A *bicephalous* or double-headed child, named Christina Ritta, lately excited curiosity in Paris. She was born in 1829, of well-formed parents, and christened at the left head by the name of Christina, and at the right by that of Ritta. Ritta was more feeble than Christina, and in journeying suffered much more than the other. Christina Ritta is double from the head to the pelvis. The two vertebral columns were distinct to their lower extremity, — that is to the coccys. Between the pelvis it is simple. Thus there were two heads resting upon two necks.

The celebrated Siamese twins, now living and married in North Carolina, are united by a cartilaginous band, attached to the breast.*

* See "Curiosities of Human Nature."

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Voice of Man. — Though most animals utter sounds more or less significant, man is the only being on whom a power of articulate speech is bestowed. This wonderful gift is the foundation of written language; it is not only the instrument by which man communicates his thoughts and feelings, but the origin of the means by which he records his knowledge. The difference between the inarticulate sounds of mere animals and human speech may be partially conceived by reflecting, that, while the former only extends to the communication of a few ideas, the latter is the foundation of that immense mass of learning recorded in the millions of books now extant. Speech is the source from which springs history, science, poetry, and universal literature; and it is through its instrumentality that the intellectual powers necessary to produce them are developed. If mankind had been dumb, they had been but little above an ingenious race of beavers.

Ventriloquism, — or belly-speaking, — which has been considered a gift depending on peculiar organs, is now universally understood to be only a high degree of mimicry, aided by tricks to cheat the imagination. It has greatly enhanced the wonder excited by ventriloquism, that the speaker utters his sounds without moving the lips, — a power acquired by art. The various kinds of divination, by means of what was considered a familiar spirit, among the nations of antiquity, are now supposed to have been ventriloquial juggles. The practice of this kind of divination now exists among the Esquimaux, and is also common among Eastern nations.

Sleep. — This is one of the most curious phenomena

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of animal life, and is shared by man with the other mammalia and birds. The lower animals, indeed, rest from time to time, and withdraw themselves from the visible world, but, having no external eyelids, they cannot exclude all influence from without. Fish conceal themselves behind a stone, or near the bank of a river, crocodiles hide themselves in the mud, and tortoises creep into holes. The higher animals likewise usually seek out some place of retirement to sleep in, and dispose themselves in a posture which either is maintained with little muscular effort, or is favorable to the preservation of warmth.

The approach of sleep is announced by diminished activity of the mind and loss of the power of attention. The senses become blunted to external impressions, and we feel an unconquerable desire for stillness and repose. Our ideas grow more confused, our sensations more obscure, our sight fails us, and, if our ears still perceive sounds, they are indistinct and seem as though distant. The eyelids close, the joints relax, we instinctively assume an easy position, and fall into a sleep which at first is deep, then soft and gentle, and becomes gradually less sound as the time for waking approaches.

Not only are the functions of organic life little affected by sleep, but even those of animal life are not in a state of complete repose. It would not be possible to make a dead body remain in those postures which we assume when asleep, and our eyelids are not closed except by muscular action. Some animals sleep standing, as the horse; birds do so also, sometimes standing on one leg. When very weary, we sleep

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even in the most constrained positions; soldiers have been known to sleep while marching, postillions on horseback, and fiddlers at a fair have continued to play even when through weariness they had fallen asleep. The numerous instances of somnambulism on record show how high a degree of activity is compatible with sleep.

Animals in general require less sleep than man; thus, for instance, four hours are sufficient for the horse. Those animals whose blood circulates very rapidly, whose motions are peculiarly energetic, and their senses very acute, usually sleep more lightly, and for a shorter time, than others. The timid herbivorous animals sleep less, and less profoundly, than the bolder carnivora. In man the want of sleep varies in different ages; the new-born infant sleeps almost continually, while persons in middle life can do with less sleep than children or very old persons, and women require less sleep than men. From six to eight hours a day are usually passed in sleep, but habit exercises a great influence in determining the amount of repose required. John Hunter and Frederic the Great did not sleep more than four hours daily, while some sluggish persons spend nearly half their time in bed. In extreme old age much sleep sometimes becomes necessary. De Moine, when eighty-three years old, was awake only four hours out of the twenty-four, and Thomas Parr, towards the close of his life, was almost constantly asleep. Children sleep very soundly, — old persons are easily disturbed, — men sleep more profoundly than women, — and sleep is always sounder after considerable weariness.

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A very important character of sleep is its periodical return once in every twenty-four hours. The idle person sleeps as well as the diligent, who has passed his time in exerting his powers of mind or body. Sleep usually occurs at night-time, and we are awake during the day, but the day may become the time for sleep, and the night for watching, if a person's occupation so require. Many animals sleep during the day, and watch or pursue their prey at night. We cannot then regard the periodical return of sleep as dependent on the simple alternation of day and night, or as merely the result of bodily fatigue, as it is known that extreme weariness will prevent sleep. The alternation of sleep and waking is essentially connected with something in the nature of animals to which there are many analogies. The succession of the seasons, and of day and night, the ebb and flow of the sea, the daily variations in the electricity of the air, in the rise and fall of the barometer, and the regular declination of the magnetic needle, eastward and westward, at different hours, illustrate the same law of periodical action, which is displayed in the unvarying alternation of sleep and waking.

Little need be said of the uses of sleep. "Nature's soft nurse," it invigorates both body and mind when worn out by toil, and the recurrence of sleep in the course of a disease is one of the most favorable signs of returning health. After a night's sleep we are nearly an inch taller than before; the intervertebral cartilages, which had been compressed by bearing the weight of the body during the day, having regained their natural form and proportion. The powers, ex-

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hausted by an intercourse with the external world, recover themselves during sleep, and our senses in the morning are alive to all impressions. It is, however, preëminently the rest of the brain, which, when fatigued with the constant action of the mind, becomes incapable of continuing that action, just as the eye, if long fixed upon one point, ceases to perceive any object distinctly.

Since, then, sleep is not a mere torpor of the system induced by fatigue, long watching, or any external cause, but a natural state, whose periodical recurrence is essential to the harmonious performance of our functions, it need excite in us no surprise to find that in certain animals this condition lasts for a long time, even for months; and that in it the activity of the organs of animal life is suspended more completely than in diurnal sleep. To this state the name of *winter sleep*, or *hybernation*, is applied.

Dreams. — These are trains of thought presenting themselves during sleep. Dogs and other animals are affected by dreams, as well as men. The dreamer is introduced into a kind of fairy land, where, as Addison, with his usual elegance and felicity, expresses it, "The soul converses with numberless beings of her own creation, and is transported into numberless scenes of her own raising; she is herself the theatre, the actor, and the beholder." In this state, when reason appears for a time to have given up the reins to fancy, it seems as if a very slight variation in the intensity of the feeling, or in the duration of the delirium, might be attended with fatal effects. Sometimes, a deed of horror is supposed to be done, or the most overwhelming calamity is believed

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to have happened. The event is depicted in the strongest colors; it is actually seen, as it were, to have happened before our eyes; the impression made upon the mind is that of assured conviction of its truth, accompanied with the most intense agony; a moment longer, and the brain would be set on fire. That boundary, however, is never passed. A provision is made by which the very violence of the agitation effects the remedy, and the dreamer awakes, with a heart ready to burst, indeed, or with nerves strung or shaken to the very verge of their utmost endurance; but the phantoms disappear, the anguish subsides, and in a few minutes the mind is as calm and serene as before.

Lord Brougham tells us, that in a state of dreaming all the bodily functions which depend upon volition are suspended; and the bodily senses, though not entirely in a state of abeyance, become very obtuse. But this does not interrupt the activity of the mind; on the contrary, the power of imagination, and the celerity with which ideas pass through the mind, are increased by this cessation of communication through the senses. The mind, therefore, acts vigorously, when the powers of the body are resting; and it is only advancing another step to suppose that it can act altogether independently of its material instrument, and survive it. To prove the extreme agility of the mental powers, and their total diversity from any material substances and actions, his Lordship enters into some curious details of the phenomena of dreaming, which incontestably prove that it sometimes requires but an exceedingly short period to suggest and complete a long train of incidents. "A puncture made," says he, in one of his

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illustrations, "will immediately produce a long dream, which seems to terminate in some such accident as that the sleeper has been wandering through a wood, and received a severe wound from a spear, or the tooth of a wild animal, which, at the same instant, awakes him. A gun fired in one instance, during the alarm of invasion, made a military man at once dream that the enemy had landed, that he ran to his post, and, repairing to the scene of action, was present when the first discharge took place, which also at the same moment awakened him."

From these facts, Lord Brougham infers the "infinite rapidity of thought." "Mark," he says, "what was done in an instant, — in a mere point of time. The sensation of the pain or noise beginning is conveyed to the mind, and sets it thinking of many things connected with such sensations. But that sensation is lost or forgotten for a portion of the short instant during which the impression lasts, for the conclusion of the same impression gives rise to a new set of ideas. The walk in the wood, and hurrying to the post, are suggested by the sensation beginning. Then follow many things connected with that sensation, except that they grow out of it; and lastly comes the wound and the broadside, suggested by the continuance of the sensation; while all the time this continuance has been producing an effect on the mind wholly different from the train of ideas the dream consists of, — nay, destruction of that train, — namely, the effect of rousing it from the state of sleep, and restoring its dominion over the body. Nay, there may be said to be a third operation of the mind going on at the same time with these

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two, — a looking forward to the *dénouement* of the plot, — for the fancy is all along so contriving it to fit, by terminating in some event, some result consistent with the impression made on the senses, and which has given rise to the whole train of ideas."

"That dreams, like any other occurrences in nature," says Dr. Good, "may occasionally become the medium of some providential suggestion or supernatural communication, I am by no means disposed to deny. That they have been so employed in former times is unquestionable; and that they have been so employed occasionally among all nations in former times is highly probable, and the peculiar liveliness with which the trains of our dreaming ideas are usually excited seems to point out such a mode of communication as peculiarly eligible."

As confirming this view of the subject, "The Penny Cyclopædia" furnishes us with the following accounts, which the editors deem authentic. "In the night of the 11th of May, 1812, Mr. Williams, of Scorrior House, Cornwall, awoke his wife, and, exceedingly agitated, told her that he had dreamed that he was in the lobby of the House of Commons, and saw a man shot with a pistol, by a gentleman who had just entered the lobby, who was said to be the Chancellor; to which Mrs. W. replied, that it was only a dream, and recommended him to go to sleep as soon as he could. He did so, but shortly after again woke her, and said that he had a second time had the same dream. The same vision was repeated a third time; on which, notwithstanding his wife's entreaties that he would lie quiet and endeavour to forget it, he arose, it being then

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between one and two o'clock, and dressed himself. At breakfast, the dreams were the sole subject of conversation, and in the forenoon, Mr. W. went to Falmouth, where he related the particulars of them to all his acquaintance that he met.

"On the following day, Mr. Tucker, of Trematon Castle, accompanied by his wife, a daughter of Mr. W., went to Scorrior House on a visit. Mr. W. related to Mr. T. the circumstance of his dreams; on which Mr. T. observed, that it would do very well for a dream to have the Chancellor in the lobby of the House of Commons, but that he would not be found there in reality. Mr. T. then asked what sort of a man he appeared to be, when Mr. W. described him minutely. Mr. T. replied, 'Your description is not at all that of the Chancellor, but is very exactly that of Mr. Perceval, the Chancellor of the Exchequer.' He then inquired whether Mr. W. had ever seen Mr. Perceval, and was told that he had never seen him, nor had ever had any thing to do with him; and further, that he had never been in the House of Commons in his life. At this moment, they heard a horse gallop to the door of the house, and immediately after a son of Mr. Williams entered the room, and said that he had galloped out from Truro, having seen a gentlemen there who had come by that evening's mail from town, and who had been in the lobby of the House of Commons on the evening of the 11th, when a man called Bellingham had shot Mr. Perceval.

"After the astonishment which this intelligence created had a little subsided, Mr. W. described most minutely the appearance and dress of the man that he

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saw in his dream fire a pistol at the Chancellor, as also of the Chancellor. About six weeks after, Mr. W., having business in town, went, accompanied by a friend, to the House of Commons, where, as has already been observed, he had never been before. Upon coming to the steps at the entrance of the lobby, he said, 'This place is as distinctly within my recollection in my dream, as any room in my house'; and he made the same observation when he entered the lobby. He then pointed out the exact spot where Bellingham stood when he fired, and which Mr. Perceval had reached when he was struck by the ball, where he fell. The dress both of Mr. Perceval and Bellingham agreed with the description given by Mr. W., even to the most minute particulars.

"The two following are among many instances mentioned by Dr. Abercrombie, who vouches for their truth. A Scotch clergyman, who lived near Edinburgh, dreamed one night, while on a visit to that town, that he saw a fire, and one of his children in the midst of it. On awaking, he instantly got up and returned home with the greatest speed. He found his house on fire, and was just in time to assist in saving one of his children, who, in the alarm, had been left in a place of danger.

"Two sisters had been for some days attending a sick brother, and one of them had borrowed a watch from a friend, her own being under repair. The sisters were sleeping together in a room communicating with that of their brother, when the elder awoke in a state of great agitation, and roused the other to tell her that she had had a frightful dream. 'I dreamed,' she said,

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'that Mary's watch stopped, and that, when I told you the circumstance, you replied, Much worse than that has happened, for ——'s breath has stopped also,' meaning their sick brother. The watch, however, was found to be going correctly, and the brother was sleeping quietly. The dream recurred the next night, and on the following morning, one of the sisters having occasion to seal a note, went to get the watch from a writing-desk in which she had deposited it, when she found that it had stopped. She rushed into her brother's room in alarm, remembering the dream, and found that he had been suddenly seized with a fit of suffocation, and had expired."

The following is written in the fly-leaf of an old Cotton's Concordance. Its circumstantial manner of narration entitles it to belief, and the prediction of the beheading of Charles the First, and of the fire, to the old woman is no more extraordinary than that of the death of Mr. Perceval to a gentleman who had never seen him, and was in no way connected with him. It is signed Richard Fiennes, to whom it is to be presumed the Concordance once belonged, and it is dated September 14, 1666, the year of the fire of London. "In the yeare 1653, on the 26th day of May, Mr. Fortescue, of Ware, in the county of Devon, a person of greate honoure and sobriety, told me at Heanton, in the same county, in the presence of my nephew Roll, and other gentlemen of quality, that there was a woman of his knowledge that was then living, that many yeares before the warres had a vision of them, and of the king's beheading; and amongst many other particulars, of the destruction of London. This I writt down in my Al-

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manac for the yeare 1653, the same day it was told me, with *Avertat Deus* written under it; but it hath pleased God that for our sinne London is now allsoe consumed. I pray God we may all receive instruction by it."

We shall conclude these instances with an account of two concurrent dreams, furnished by Dr. Abercrombie, which were not, like those we have already given, followed by the event, on which they are said to have turned, but of which the coincidence is very extraordinary. "A young man, who was at an academy a hundred miles from home, dreamed that he went to his father's house in the night, tried the front door but found it locked; got in by a back door, but, finding nobody out of bed, went directly to the bedroom of his parents. He then said to his mother, whom he found awake, 'Mother, I am going a long journey, and am come to bid you good by.' On this, she answered, under much agitation, 'O dear son, thou art dead.' He instantly awoke, and thought no more of his dream, until, a few days after, he received a letter from his father, inquiring very anxiously after his health, in consequence of a frightful dream his mother had on the same night in which the dream now mentioned occurred to him. She dreamed that she heard some one attempting to open the front door, then go to the back door, and at last come to her bedroom. She then saw that it was her son, who came to the side of her bed and said, 'Mother, I am going to take a long journey, and am come to bid you good by,' on which she exclaimed, 'O dear son, thou art dead.' But nothing unusual happened to either of the parties."

Somnambulism. Mesmerism.—Somnambulism lit-

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erally means sleep-walking, but in its more extended sense it includes all the phenomena that take place, when a person, apparently insensible to external objects, acts as if he were in a state of consciousness.

The following account is copied from the "French Encyclopædia," and is given on the authority of the Bishop of Bordeaux. "A young ecclesiastic was in the habit of getting up during the night in a state of somnambulism, of going to his room, taking pen, ink, and paper, and composing and writing sermons. When he had finished one page of the paper on which he was writing, he would read over aloud what he had written and correct it. Upon one occasion, he had made use of the expression, 'Ce divin enfant.' In reading over the passage, he changed the word 'divin' into 'adorable.' Observing, however, that the pronoun 'ce' could not stand before the word 'adorable,' he added to it the letter *t*. In order to ascertain whether the somnambulist made any use of his eyes, the Archbishop held a piece of pasteboard under his chin, to prevent him from seeing the paper upon which he was writing, but he continued to write on, without being apparently incommoded in the slightest degree. The paper upon which he was writing was taken away, and other paper laid before him, but he immediately perceived the change. He wrote pieces of music while in this state, and in the same manner, with his eyes closed; the words he placed underneath the music. It happened upon one occasion that the words were written by him in too large a character, and did not stand exactly under the corresponding notes; he soon perceived the error, blotted out the part, and wrote it over again with great exactness."

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Gassendi tells us of a man who used to rise and dress himself in his sleep, in order to go to a cellar to draw wine from a cask. He appeared to see in the dark, as well as in a clear day; but when he awoke, either in the street or cellar, he was obliged to grope and feel his way back to his bed. He always answered as if awake, but in the morning recollected nothing of what had happened. Another sleep-walker, a countryman of Gassendi's, passed on stilts over a frozen torrent in the night, but, on awaking, was afraid to return before daylight, or before the water had subsided. This species of somnambulism has been known to be hereditary.

Animal Magnetism, Mesmerism, or artificial somnambulism, has recently excited great interest in this country, and though it has been seized upon by quacks and impostors grossly to deceive the public, a careful analysis of indisputable facts will lead to the conclusion that the subject is well worthy of scientific inquiry.

It is claimed for Mesmerism that, by certain passes of the hands, and an exertion of the will, an impressible person may be put into a magnetic or somnambulic state, — during which the senses are asleep, while the mind is unusually active, and sometimes realizes the most extraordinary perceptions, — called *clairvoyance*. The reality of this artificial magnetic sleep is now admitted by scientific men, and numerous instances are on record in which the drawing of teeth, amputation, and other painful surgical operations, have been performed upon patients in this condition, they being insensible to the whole proceeding. Among these instances, we quote one, which occurred in 1831, the operation being performed by M. Cloquet, and reported under a commission by the Royal Medical Academy of Paris.

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In this instance, a woman aged sixty-four, having a cancer in the right breast, and there being no other hope of recovery, was placed in a mesmeric state, and the tumor amputated. The report of the case is as follows: —

"At the time appointed, M. Cloquet, the surgeon, found the patient dressed, and seated in an elbow-chair, in the attitude of a person enjoying a calm, natural sleep. She had been thrown into a state of somnambúlism, and talked with great calmness of the operation. She undressed herself, and sat down upon a chair. M. Chapelain, who had magnetized her, supported the right arm; the left was permitted to hang down at the side of the body. M. Cloquet then deliberately performed the operation, which lasted from ten to twelve minutes, and the tumor was extirpated. During all this time, the patient continued to converse quietly with the operator, and did not exhibit the slightest sign of sensibility. There was no motion of the limbs, or of the features; no change in the respiration, nor in the voice; no emotion even in the pulse. The patient continued in the same state of automatic indifference and impassibility in which she had been some minutes before the operation. There was no occasion to hold, but only to support her. A ligature was applied to one of the thoracic arteries, which had been opened during the extraction of the glands. The wound was united by means of adhesive plaster, and dressed. The patient was put to bed while in a state of somnambulism, in which she was left for forty-eight hours. An hour after the operation, there appeared a slight hemorrhage, which was attended with no consequences.

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The first dressing was taken off and the wound was cleaned and dressed anew; the patient exhibited no sensibility or pain, and the pulse preserved its usual rate. After this dressing, M. Chapelain awakened the patient, whose somnambulic sleep had continued from an hour previous to the operation, that is to say for two days. She did not appear to have any idea of what had passed in the interval; but upon being informed of the operation, and seeing her children round her, she experienced a very lively emotion, which the magnetizer checked by immediately setting her asleep."

Instances similar to this have frequently taken place, both in Europe and in this country, and very recently the following case occurred in the city of New York. "Some of our principal physicians," says a correspondent of the National Intelligencer, January, 1845, "are likely to become converts at length to a belief in the truth of the much-abused science of Mesmerism. A most convincing evidence of the power and reality of the mesmeric agency was exhibited in this city on Thursday last, the 16th instant, in the presence of Doctors Mott, Francis, Doane, Delafield, Rogers, and others, —all of them men acknowledged to stand in the front rank of their profession. A young lady of respectability residing in Chambers Street, while in the somnambulic state induced by Mesmerism, had a tumor removed from her neck near the carotid artery. The mesmerizer and surgical operator was Dr. Bertronnier, a young man of fine abilities, who has recently arrived here from Paris. The subject submitted to the severe operation without the slightest manifestation of physical pain or shrinking, — a serene smile playing upon her

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lips as the knife cut deep into the flesh. After the operation was ended, an apparent disposition to awaken from the magnetic trance was immediately dispelled by a few passes of the magnetizer's hand. The eminent physicians who were present, nearly all of whom came 'prepared to scoff,' regarded one another in silent amazement at the successful close of the experiment. As one of the most distinguished of them remarked to me, their looks seemed to say, 'Have we not disbelieved in these things too long?' The case was in all its details of a most convincing character."

As to the pretensions of Mesmerism to enable the mind of the somnambule to perceive and realize objects and scenes at a distance, and give an account of the same by means of a power called *clairvoyance*, we must speak with more reserve; though it would be easy to cite many well authenticated instances in which this wonder seems to have been achieved. If the mesmeric sleep be established, as it certainly is, it is difficult to resist the evidence of the still higher powers said to be conferred by this condition of the body. We may remark, however, that most of the marvels which are related on this subject are the work of imposture or delusion. "But," says "The Penny Cyclopædia," "after all this mass of knavery has been cleared away, there still remains a large number of instances which cannot be disbelieved without discarding all historical evidence whatever."

PHYSICAL VARIETIES OF THE HUMAN RACE. — In attempting to form a classification of the human race according to its physical varieties, the most eminent philosophers agree in considering man as forming a

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single species of the genus, and differ only as to the number of varieties into which it is to be subdivided. The celebrated Cuvier includes all these varieties under three primary divisions, which he terms; 1. The Fair, or Caucasian variety; 2. The Yellow, or Mongolian; 3. The Black, or Ethiopian. Blumenbach extends these primary divisions to five, of which we shall here give a survey.

I. The CAUCASIAN variety, characterized by a white skin; red cheeks; copious soft, flowing hair, generally curled or waving; ample beard; small, oval, and straight face, with features distinct; expanded forehead; large and elevated cranium; narrow nose; and small mouth. This race has given birth to the most civilized nations of ancient and modern times, and has exhibited the moral and intellectual powers of human nature in their highest degree of perfection. This variety derives its name from the group of mountains between the Caspian and the Black Sea, because tradition seems to point to this part of the world as the place of its origin. Thence its different branches have issued at various periods, in different directions, and here even at the present day we find its peculiar physical characteristics in the highest perfection, among the Georgians and Circassians, who are considered the handsomest people in the world.

It embraces several branches, distinguished by analogies of language, namely; 1. The *Syrian branch*, comprising the Chaldeans, Assyrians, Phœnicians, Jews, Arabs, Egyptians (Copts), Abyssinians (Arab colonies), &c. From this branch, which directed its course southwards, have sprung the religions which have

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proved the most durable and the most widely extended over the West.

2. The *Indo-Pelasgic branch*, comprising Hindoos, Persians, Greeks, Romans, Celtic Nations (Ancient Gauls, Celtiberians, Britons, &c., Welsh, Irish, Scotch Highlanders, &c.), Teutonic Nations (Germans, Danes, Swedes, Norwegians, Dutch, English, &c.), Sclavonic Nations (Russians, Poles, Servians, Croatians, Bohemians, Slowacs, Wends, &c.), Romanic Nations (French, Spaniards, Portuguese, Italians, Belgians, Wallachians, &c.). The nations which compose this branch have carried philosophy, science, and the arts to the highest perfection, and for more than three thousand years have been the depositaries and guardians of knowledge.

3. The *Scythian* or *Tartarian branch*, comprising Scythians, Parthians, Turkish Nations (Usbecs, Turkmans, Kirghises, Osmanlees or Ottoman Turks, &c.), Uralian Nations (Finlanders, Hungarians or Magyars, Esthonians, Sames or Laplanders, &c.). Accustomed to a roving and predatory life in the vast steppes of Asia, these wanderings tribes have left them only to devastate the inheritance, and subvert the civil institutions, of their more polished brethren.

II. The MONGOLIAN variety has these characteristics: — the skin, instead of being white or fair, is olive-yellow; the hair, thin, coarse, and straight; little or no beard; broad, flattened face, with the features running together; small and low forehead; square-shaped cranium: wide and small nose; very oblique eyes; and thick lips. Stature inferior to the Caucasian. In this race the moral and intellectual energies have been developed in an inferior degree.

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This variety, which stretches eastwardly from the Scythian branch of the Caucasian race to the shores of the Pacific Ocean, and which has mostly retained the wandering life, appears to have had its origin in the Altai Mountains, whence it has thrice carried the terror of its name, under Attila, Gengis, and Tamerlane, over half the Old World. The Chinese, belonging to this variety, are by some thought to have been the most early civilized of all the nations of the world. It comprises the Chinese, or mass of the population of China, Coreans, Japanese, Tungooses (Tungooses proper, in Siberia, and Mantchoos, the ruling people of China), Mongols (Mongols proper, Kalmucs, &c.), Birmese or Myammas, Annamites (Cochinchinese, Tonquinese), Siamese, Samoyedes, and numerous other Siberian hordes, Esquimaux (classed by some in the American variety), &c.

III. The AMERICAN variety, has the skin dark, and more or less red; the hair is black, straight, and strong, with the beard small; face and skull very similar to the Mongolian, but the former not so flattened; eyes sunk; forehead low; the nose and other features being somewhat projecting.

The moral and intellectual qualities of this race approach those of the Mongolian; like that it has remained stationary, but it has stopped at a point much below the Asiatic variety. The ancient and now extinct empires of Mexico and Peru may be considered analogous to those of China and India, exhibiting the highest point of civilization to which the two races have reached; but arts, sciences, and all those intellectual endowments which to a certain extent belong

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to the Asiatics, appear to have made little or no progress among the Americans.

The American race, blending with the Mongolian to the north, spreads over the whole of the new world; but whether any traces of it exist beyond these limits is a question which has not been investigated.

IV. In the ETHIOPIAN variety, the skin is black; hair short, black, and woolly; skull compressed on the sides, and elongated towards the front; forehead low, narrow, and slanting; cheek-bones very prominent; jaws projecting so as to render the upper front teeth oblique; eyes prominent; nose broad and flat; lips, especially the upper one, very thick. Different branches of this race spread over the whole of the African continent, excepting those parts bordering on the north and east of the Great Desert, which are occupied by Caucasian Syrians, and in which all traces of the negro formation disappear.

The extension given to this variety seems to be rather arbitrary, and a more correct division of the African races will probably be the result of a better acquaintance with that continent. There is, indeed, little in common between the Negro and the Berber, and the Hottentot and the Caffre. The Ethiopian variety comprises the following leading branches, viz.:

1. *The Hottentots* (Coronas, Namaquas, Bushmen, and other tribes within the Cape Colony, and the basin of the River Orange).

2. *The Caffres* (Coosas, Tambookis, Betshuanas, &c., extending from Port Natal to an uncertain distance north).

3. *The Negroes*, occupying the whole continent

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from about Lat. 20° N. to the southern tropic, with the exception of some regions on the eastern coast, and including numerous families of nations.

4. *The Gallas* (comprising numerous wandering tribes who have conquered a great part of Abyssinia and the neighbouring countries).

5. *The Barabras* or *Berbers* (including the native tribes of Northern Africa — Berbers proper, Tuaricks, Tibboos, Shelluhs, &c. of the Atlas region — and the Nubas, Kenoos, Shangallas, Shillooks, Darfurians, Somaulis, &c., to the east).

The Ethiopian variety has ever remained in a rude and comparatively barbarous state; their cities are but collections of huts; their laws, the despotic whim of the reigning chief. Incessantly occupied in war and the chase, they do not seek to perpetuate their ideas; they have no written language, the Arabic being the only character used in Africa, and, although abundantly supplied with the necessaries of life, they have retained their condition unchanged, after centuries of intercourse with enlightened nations. Let us hope that a better destiny awaits them.

V. The MALAY race varies in the color of the skin from a light tawny to a deep brown approaching to black; hair black, more or less curled, and abundant; head rather narrow; bones of the face large and prominent; nose full and broad towards the lips. Such is the account given by many writers of this variety, which is spread all over Oceanica, and is found in Malacca, in Asia, and on Madagascar, in Africa; but it certainly includes races of very different physical and moral qualities.

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We may divide it into the Malayan race and the Melanesian or Papua race: the former is of a lighter complexion, longer hair, and somewhat oval countenance; some of the nations of this race have long possessed alphabets, and made considerable advances in civilization, while others are in a low state; the latter have the black complexion and woolly hair of the negroes, and are in the most degraded social condition, living by fishing, or on the spontaneous productions of the earth, without clothing, without huts, and even without arms, except of the rudest construction. They form the original inhabitants of the great islands of Australia and are found in the interior of the other principal islands of Oceanica, in which the Malayan races are generally the ruling people.

The Papuan race are considered by some naturalists as belonging to the Ethiopian variety, to which they have a strong resemblance, though inferior to them in capacity.

The Malayans proper include the following: — the Javanese, Malays of Sumatra, Borneo, Molucca, the Moluccas, &c., the Battaks and Achinese of Sumatra; the Bugis, Macassars, and Alfourous, of Celebes; the Dayaks, or Harafouras, of Borneo; the Tagals, Bissayos, Sooloos, and Mindanaos, of the Philippines; the Carolinians, New Zealanders, Feejeeans, Sandwich Islanders, Society Islanders, Friendly Islanders, &c.

Concluding Observations. — The existences which we notice in the world are easily distinguished into two classes, *material* and *immaterial*. The *material* class consists of bodies which are always divisible into atoms by the mechanical or chemical agents calculated

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to act upon them. The *immaterial* comprises all living principles, all degrees of sensitivity, the soul of man and the Deity! No immaterial existence or being is capable of division into atoms or molecules. Life cannot be cut asunder, any more than the power of feeling or that of thought. If you take off the limb of a feeling animal, though you disunite that into a separate part, you carry no feeling with it. The severed limb, once severed from that body which contains the sentient principle, has no sensitivity after the amputation. This is the great distinction of all immaterial being. It is indivisible; it is not a composition; it is undissolvable; it is always a one whole; a perfect singularity; an uncompounded thing. The term *being* is more properly its denomination than *thing;* because being or living existence is also its invariable and inseparable characteristic. Life or being is the universal companion and mark of all that is immaterial. What feels must live; what thinks must live; the soul pre-eminently so. Yet life, as we see in vegetables, is not necessarily united with either feeling or thought. Feeling is life combined with sensitivity; and this combination may exist without a reasoning faculty, as in the lowest classes of animated nature. Mind is life combined with feeling and thought; and this may subsist, as in brutes, without the human soul. Our spirit is an additional nature: it is the union of life, feeling, and thought, with its highly born and most distinguished self; and all these orders of immaterial being are realities in nature, distinguishable from each other as they are from the eternal Source and Sovereign of them all, the almighty and everlasting Creator, from whom, and

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from whom alone, all life, feeling, thought, and spirit have proceeded.

Thus there appears to be in existing nature, so far as we at present know it, and to be there distinctly perceptible by us, FOUR classes or orders of immaterial being, which are not each other, but which are all separate essences or animated things, and which subsist manifestly apart from each other, with very distinguishing properties. The first of these is indeed so superior that it is almost profane to associate it with the others; but, as it is the fountain of all, it may be reverentially placed at the head of all immaterial being, though with the impression of being at an infinite distance and unapproachable exaltation: —

I. The supreme eternal Creator of all

II. The human soul.

III. The animal mind.

IV. The vegetable living principle.

Each of the three last is at a great distance from the other in power and qualities, descending in the scale from the human spirit to the plant.

Thus the gracious Deity, as the author and source of all that is immaterial, possesses in himself all spirit, mind, feeling, and life, and has distributed them respectively to his creatures as he has thought fit. The human spirit has also perceiving and thinking mind, sensibility, and the principle of life, but is not its divine maker. Brutes have sensations, perceptions, memory, will, comparing thought, and a deciding judgment; though varying in degree, they have also feeling and life; but they have not the human soul, and cannot do what that does, nor be what that is. So plants have

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that living principle which places them in the ranks of immaterial beings; but they have not the animal sensitivity, nor a perceiving or thinking mind, nor a human spirit. They are the lowest order of immaterial being. In them, an immaterial principle is united, in its simplest state, with a material organization and substance. They are thus a compound of two natures, or classes of existence. They are at the same time material things, and immaterial beings; but they are beings without the sensitivity and degree of mind which animals possess. They are immaterial beings of their own class and kind, strictly limited to that, and clearly defined to the eye and judgment of every one by that limitation; but their material substance is as truly not their principle of life, as their living principle is not their material substance.*

MAN IN HIS SOCIAL AND MORAL CHARACTER.

We have hitherto viewed man in his physical character, and as possessing qualities which ally him to the higher forms of organized nature. We now proceed to consider him in his mental and social capacity.

Notwithstanding all the varieties of the human race, he everywhere maintains, says Smellie, a decided rank far above any other animal. He is the only one

* We have here, and in some of the preceding pages, used the words of Turner, in his "Sacred History of the World."

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which has the power of communicating its thoughts and feelings by articulate speech; the only one which can properly be said to avail itself of the advantages of society; and the only one that, strictly speaking, educates its young. It is in consequence of these advantages, particularly that derived from association, that he has been enabled, under all circumstances, to acquire and preserve a dominion over other animals, either by subjecting them to his use, or at least making himself the object of their fear. It is in consequence of these advantages, also, that he has been enabled to protect himself against the severity of climates, and thus spread his species over every part of the earth. Naturally tender and defenceless, he could only exist in the most equable and temperate climates; but, aided by the inventions and discoveries of social life, he is enabled to brave the cold of the polar circle, as well as the overpowering heat of the regions on the equator.

Man is only partially governed by instinct. His knowledge is the result of education and experience. He knows nothing but what he has discovered himself, or what has been taught him by others. By means of language and writing, the discoveries and improvements of one generation are transmitted to the next, and they are the ground of an almost indefinite progress towards perfection. Other animals, being principally governed by instinct, are stationary; they neither advance nor recede in their manners or habits; by being associated one with another, they do not improve; and although capable of being educated by man, they do not educate one another. The first swarm of bees that existed probably constructed as

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perfect a honeycomb as is done now; they do not improve upon the plan which instinct has pointed out to them; it is a plan which they did not in the first place contrive, and cannot amend. But if we compare the rude and ill-constructed habitations of savage nations with the splendid and luxurious edifices of civilized life, we instantly perceive the influence which language, society, and education have had upon the human race. We are sensible of the great difference between that skill which is the result of instinct, and that which is acquired by being capable of reasoning and speaking.

Being thus susceptible of constant progress in improvement, man is found under different circumstances in different stages of his progress. In his primitive state, he supports himself upon the flesh of animals, which he destroys in the chase, or upon the wild fruits of the forest. He has not, therefore, time to devote to the cultivation of the arts, or to the education of his children; he learns nothing but how to construct his hut and his canoes; he clothes himself with the skins of wild beasts, and he observes the natural objects around him, so far only as he can make them subservient to his purposes. When he comes into the possession of the domestic animals, the cow, the horse, the sheep, &c., he finds that he can derive an easier and less precarious subsistence from their milk and flesh, than from the products of the chase. He rears, therefore, numerous herds of these animals, and being only occupied in finding them pasturage and shelter, is comparatively at leisure to apply himself to some of the arts of civilized life. He manufactures clothing from their

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skins, and wool of various degrees of delicacy and elegance. He builds himself more commodious habitations, and from the different degrees of industry and skill with which different individuals apply themselves to these occupations arises an inequality of conditions. Some become rich, and others comparatively poor. The rich acquire a disposition to indulge in the comforts and luxuries of life, and this is found to be inconsistent with the wandering and unsettled condition of mere shepherds. Hence they are induced to fix themselves permanently upon particular tracts of country which come to be considered as their property; and thus they gradually devote themselves to the cultivation of the soil. This enables a given portion of land to support a much greater number of people than when it was devoted to the feeding of herds; and hence, as agriculture becomes established, the population of a country regularly increases, and society also becomes settled and permanent. Every individual is able to produce more by his labor than is sufficient for his own support, and some, therefore, devote themselves to other occupations, the results of which they exchange with the laborer for his surplus. Nations also exchange their superfluities with one another. Thus commerce is established; and the arts and elegancies of life are one by one brought to light, as the growing wealth of individuals and nations creates a demand for them.

GRAND DIVISIONS AND NATIONS OF THE GLOBE. — The world is generally considered under five grand divisions, as follows.

America. — This portion of the globe embraces

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about 15,000,000 square miles, and a population of nearly 50,000,000, thus distributed: —

North America, West Indies, and Guiana.		South America.	
Russian America,	50,000	New Grenada,	1,680,000
Danish America,	110,000	Venezuela,	900,000
British America,	2,150,000	Equator,	650,000
United States,	20,000,000	Peru,	1,700,000
Spanish Islands,	1,050,000	Bolivia,	1,300,000
Hayti,	600,000	Chili,	1,400,000
French America,	240,000	La Plata,	1,800,000
Dutch America,	114,000	Uruguay,	90,000
Mexico,	8,000,000	Paraguay,	250,000
Texas,	100,000	Brazil,	5,000,000
Guatemala,	2,000,000	Independ. Indians,	1,400,000
	34,414,000		16,170,000

Of this number, about twenty millions are whites; ten millions, of the aboriginal race; nine millions, negroes; and the remainder, mixed races; the latter, called *mestizoes*, being chiefly within the Spanish settlements.

Europe. — This division of the world, though containing but about 3,500,000 square miles, and therefore smaller in extent than either of the other four, must still be regarded as taking the lead in the arts and sciences, in literature, and in knowledge. Though it was settled long after Asia, though it is less extensive, less populous, and less fertile than that cradle of the human family, still it has greatly outstripped it in all that belongs to civilization.

The leading nations of Europe, with their population, are exhibited in the following table: —

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Great Britain and Ireland,	26,863,957	Germany,	38,204,000
France,	34,000,000	Prussia,	14,500,000
Spain,	12,000,000	Holland,	2,545,000
Portugal,	3,400,000	Belgium,	4,230,000
Italy,	21,800,000	Denmark	2,150,000
Greece,	180,000	Norway and Sweden,	4,300,000
Turkey,	10,000,000	Russia,	54,000,000
Switzerland,	2,200,000		
Austria,	35,000,000		265,372,957

Africa. — This quarter of the globe contains 11,500,000 square miles, and a population of sixty millions. The Arabs and Moors, who chiefly occupy the northern parts, are of Asiatic origin; but there are four great families of nations, strongly marked by physical characteristics, who appear to be indigenous to this quarter of the globe. These are the *Berbers*, who are mixed with the Arabs and Moors; the *Negroes*, who pervade Central Africa; and the *Hottentots*, and the *Caffres*, of the South.

Asia. — This country was the cradle of the human family, and to this quarter we must look for the origin of the various tribes which now inhabit the earth; yet two of the great races of mankind — the Negro and the American Indian — are not now to be found within its limits. Still, there is no quarter of the globe where human society presents such a diversity of aspects as here.

Asia is about sixteen million square miles in extent, and contains nearly one third part of the land surface of the earth. The following table exhibits its general divisions, with the population of each.

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Russia in Asia,	7,000,000
Turkey in Asia,	12,000,000
Arabia,	10,000,000
Persia,	12,000,000
Afghanistan and Beloochistan,	10,000,000
Independent Tartary,	7,000,000
Chinese Empire,	340,000,000
Japan,	12,000,000
Hindostan,	140,000,000
Farther India,	20,000,000
	570,000,000

It may be proper to state that there is great diversity in the estimates of Chinese population, some authors rating it as low as two hundred millions. Several recent writers, however, of high authority, give it as in the preceding table.

Oceanica. — Under this title are embraced the numerous islands of the Pacific, which comprise an area of land of about 4,500,000 square miles, and contain a population of perhaps twenty millions of people. Among them, there are two leading races, — the Malays, who inhabit most of the islands, and a peculiar kind of negroes, who are widely scattered, but are most numerous in Australia and New Guinea.

POLITICAL INSTITUTIONS. — 1. *Government.* — The government of a state is the body or bodies of men, to which are intrusted the power of making and executing the laws, the management of the public concerns, and the defence and promotion of the general welfare.

2. *Powers and Branches of Governments.* — The most important powers of a government are, that of making laws, or the legislative power; that of interpreting or applying them to individual cases, or the judicial

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power; and that of executing them, or the executive power. Each of these powers is, in many states, confided to a distinct body, and the government is, therefore, divided into three independent branches, the legislature, the judiciary, and the executive. This is the case in the United States.

3. *Forms of Government.* — There are various forms of government differing in their character and appellation, according to the disposition of the powers of government in few or many hands, and the organization of the different branches.

I. A monarchical government is one in which the supreme power is exercised by a single individual; if the sovereign succeeds his predecessor by right of inheritance, it is a hereditary monarchy; if he is chosen by the nation, or certain privileged classes or dignitaries, it is an elective monarchy. France, England, Spain, &c., are hereditary monarchies.

II. When the sovereign has no law but his own will, and can dispose at pleasure of the lives, persons, and property of his subjects, the government is a despotism; if the sovereign unites all powers in himself, but is bound by the laws, the government is an absolute monarchy. Of this character are the governments of Russia, Turkey, and most Asiatic kingdoms.

III. When the authority of the head of the state is restricted by the concurrent authority of the representatives of the nation, or of certain privileged classes of the nation, the government is called a limited or constitutional monarchy. Such are the governments of Great Britain, France, Belgium, Holland, &c.

IV. A republican government is one in which the

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supreme power is in the hands of the whole body of the people, or is exercised by the principal citizens; in the former case, it is called a democracy, or democratic republic; in the latter an aristocracy, or aristocratic republic. The United States, Mexico, and all the South American States except Brazil, are democratic republics.

v. States are also differently denominated according to the title of the sovereign, without regard to the form of government; thus a monarchy is styled an empire, kingdom, duchy, principality, electorate, landgraviate, &c., according as the head of the state bears the title of emperor, king, duke, prince, elector, landgrave, &c.

4. *Colonies.* — Colonies are establishments founded by states, or sometimes by individuals, in foreign countries, for commercial or benevolent purposes, and subject to the authority of the mother country. Factories are trading stations established in foreign countries. Colonies founded by the transportation of convicted criminals are called penal colonies. Such are the establishments of Great Britain in New Holland and Van Diemen's Land.

Religions. — The religious opinions of mankind are infinitely diversified, but they may be classed under two general heads, — one comprising those nations which acknowledge the existence of a supreme God, the creator, preserver, and ruler of all things, and the other including those which do not recognize the existence of a supreme intelligence.

1. *Fetichism, Sabeism.* — To the latter class belong the innumerable forms of superstition which prevail among ignorant and barbarous tribes. Fetichism is the

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worship of fetiches, that is of various living or inanimate objects of nature; the elements, rivers, fire, trees, and whatever else the credulous savage sees endowed with powers of good or evil, become the objects of gratitude or fear, and worship. Different forms of fetichism prevail among the negro tribes of Africa, in Australia, Polynesia, and in some parts of Asia and America. The sacrifice of human victims often forms a part of its horrid rites. Sabeism is the worship of the heavenly bodies, the sun, moon, and stars; this is an ancient form of religious faith, but has ceased to prevail very extensively.

2. *Judaism.* — Judaism acknowledges no revelation but that made to the Hebrews by Moses and the prophets. The Jews are the descendants of the ancient Hebrews, and, though dispersed over all parts of the world, they preserve their ceremonies and faith. Their sacred books are the books of the Old Testament, written originally in Hebrew; they still expect the coming of the Messiah promised by their prophets, and observe the seventh day of the week as the Sabbath. Since their dispersion, they have ceased to offer the sacrifices prescribed by the law, and, instead of their ancient priests or Levites, they have substituted Rabbins, or learned men, who expound the law in the synagogues. Among the Jewish sects are the Talmudists, so called because they receive the Talmud, a collection of traditions and comments upon their sacred books; the Caraites, who reject the absurd traditions and superstitious follies of the Talmud; the Rechabites, who live in the oases near Mecca, and receive only the earlier books of the Old Testament; and the Samaritans, who still offer sacrifices on Mount Gerizim.

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3. *Christianity.* — Although founded on Judaism, and originating among the Jews, Christianity teaches that the Messiah promised by the Jewish prophets has come, and brought a new revelation to men, and that Jesus Christ is this Messiah; the New Testament contains the revelations of this divine teacher.

4. *Mahometanism.* — Islamism, or Mahometanism, was founded by Mahomet, or Mohammed, an Arabian, who, admitting the divine mission of Moses and Jesus Christ, and acknowledging the sacred character of the Old and New Testaments, claimed to be charged with new revelations from God. Islamism teaches the immortality of the soul, a future judgment, &c.; it prescribes prayer five times a day; frequent ablutions; fasting during the month Ramazan; yearly alms, to the amount of the fortieth of one's personal property; pilgrimage to Mecca, and some other rites; the temples are called mosques, and divine service is performed in them every Friday.

The sacred book of the Mahometans is the Koran, an Arabic word signifying *the book;* it is written in Arabic. The principal Mahometan sects are the Sonnites, who acknowledge the authority of certain traditions and commentaries on the Koran; the Shiites, including the Nosairians, Ismaelians, Druses, &c., who reject these traditions; the Yezids, whose religious system consists of a mixture of Christianity and Mahometanism; and the Wahabites, an Arab sect, which arose during the last century, and has endeavoured to effect a reformation of Islamism by purging it of human corruptions and restoring its primitive simplicity.

5. *Brahmanism.* — Brahmanism recognizes the ex-

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istence of a supreme intelligence, Brahm, but teaches that he governs the world through the medium of numerous subordinate deities. The principal of these are Brahma, the Creator, who presides over the land; Vishnu, the Preserver, presiding over water; and Siva, the Destroyer, who presides over fire; these three persons are, however, but one God, and form the Trimourti, or Hindoo Trinity. The Hindoos, who profess this faith, have several sacred books, called Vedas, written in Sanscrit, and forming their code of religion and philosophy; they teach the metempsychosis or transmigration of souls, and the immortality of the soul, and prescribe a great number of fasts, penances, and rites. Pilgrimages, voluntary death, self-torment, ablutions, &c., are practised, and the females of the two higher castes are required to burn themselves on the dead bodies of their husbands.

6. *Buddhism.* — Buddhism resembles Brahmanism in many points. It is the prevailing religion in Thibet, Ceylon, the Birman empire, and Annam; and is professed by a portion of the people of China, Corea, and Japan. Buddhism teaches that the universe is inhabited by several classes of existences, partly material and partly spiritual, which rise by successive transmigrations to higher degrees of being, until they arrive at a purely spiritual existence, when they are termed Buddhas. These holy beings descend from time to time upon earth in a human form to preserve the true doctrine among men; four Buddhas have already appeared, the last under the name of Shigemooni, or Godama.

7. *Nanekism.* — Nanekism, or the religion of the Seiks, founded by Nanek in the fifteenth century, is a

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mixture of Mahometanism and Brahmanism. The Seiks adore one God, believe in future rewards and punishments, and reject the use of images as objects of worship; they receive the Vedas and the Koran, as sacred books, but think that the Hindoos have corrupted their religious system by the use of idols.

8. *Doctrines of Confucius.* — The Doctrine of the Learned, or the Religion of Confucius, is the received religion of the educated classes of China, Annam, and Japan; it uses no images, and has no priests, the ceremonies being performed by the civil magistrates. The rites, such as the worship of the heavens, stars, mountains and rivers, genii, and souls of the departed, are esteemed merely civil institutions.

9. *Magianism.* — Magianism, or the Religion of Zoroaster, teaches the existence of a supreme being, Zervan, or the Eternal, subordinate to whom are Ormuzd, the principle of good, and Ahriman, the principle of evil, who wage a perpetual warfare; numerous inferior deities and genii take part in this struggle, in which Ormuzd will finally prevail. The sacred books of the Magians are called the Zendavesta. The ceremonies consist chiefly in purifications, ablutions, and other rites, performed in the presence of the sacred fire, the symbol of the primeval life; hence the Magians are erroneously called fire-worshippers.

The numbers of the adherents of each religious system have been estimated as follows:

Christianity.		Judaism,	4,600,000
Roman Catholics,	139,000,000	Mahometanism,	120,000,000
Greek Catholics,	62,000,000	Brahmanism,	100,000,000
Protestants,	59,000,000	Buddhism,	200,000,000
		Other religions,	146,000,000
	260,000,000		
		Total,	830,000,000

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SUPERSTITIONS.

MANKIND have in all ages been prone to the most lamentable superstitions. The enlightened nations of antiquity were no more exempted from them than the most ignorant. The Jews, as we are repeatedly informed in Scripture, could with difficulty be restrained from idolatrous and superstitious practices, and confined to the worship and service of the true God. This remarkable tendency of the Hebrew nation was probably caused by their sojourn, for the space of four hundred years, among the Egyptians, whose system of religion was a mass of idolatrous observances. They had a number of ideal gods, to whom they erected temples of prodigious size and great architectural splendor; the principal of these deities were Osiris and Isis, which are thought to have been typical of the sun and moon. But they also offered worship to various animals, as the ox, or bull, — to which they gave the name of Apis, — the dog, the wolf, the hawk, the ibis or stork, the cat, and other creatures; they likewise paid adoration to the Nile, personifying it by the crocodile, to which temples were erected, and priests set apart for its service. The Egyptians, notwithstanding their learning, also believed in dreams, lucky and unlucky days, omens, charms, and magic. In a word, they were grossly superstitious, and seem to have had but a feeble conception, if any, of the laws which regulate the ordinary phenomena of nature.

The absurdities of Egyptian superstition formed a basis for what followed among the Greeks and Ro-

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mans, who had but a faint idea of an omnipresent and omnipotent God, the Creator and Ruler of the universe. Their notions of divinity, like those of other pagans, were grovelling and contemptible. The gods whom they adored were imagined to have been at one period rulers or heroes on earth, and still had their habitation somewhere within the Grecian territory, or at no great distance from it. Besides their belief in this vain mythology, both Greeks and Romans put faith in divination, oracles, the magical power of amulets, and dreams. Bees, ants, and various reptiles and beasts, were imagined to have the power of giving omens of good or bad fortune. The phenomena of the atmosphere and planetary bodies were likewise a fertile source of superstitious delusions. The appearance of comets, and also eclipses, were ominous of great public disasters, it being the general belief that they were special signs made by the gods to warn mankind of approaching troubles; in all which we see a lamentable proof of the follies to which even a refined people may be exposed, if ignorant of the laws of nature.

The superstitious delusions of the Greeks and Romans may be said to have died out at the final dismemberment of the Roman empire, and the overrunning of Western Europe by the Gothic nations. The introduction of Christianity also tended powerfully to root out the old superstitious usages, though a few survived to a later date. For these reasons, the superstitions and matters of credulous belief which afterwards affected the people of Northern and Western Europe, including the British Islands, were in a great measure of Scandinavian and Gothic origin. The only superstitions of

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Eastern growth worthy of mention, which were perpetuated in Europe generally, were astrology, or a belief that the stars exercised an influence over the destiny of mortals, and alchemy, or the pretended art of transmuting the baser metals into gold; both of which delusions finally vanished before the light of knowledge that spread abroad in the seventeenth and eighteenth centuries.

Scandinavian Superstitions. — The superstitions of the European Northmen, or Scandinavians, — under which term are included the early inhabitants of Denmark, Norway, Sweden, and Iceland, — were of a kind remarkably accordant with the cold and stern character of the regions which they occupied. Like the ancient Greeks, the Scandinavians had seats of the gods and of the blest, which they called Asgard and Walhalla, and these bore the same relation in their character to the Olympus and Elysium of the Greeks, that the countries of the North, with their stormy climes, their icy mountains, and perilous waters, bore to the perfumed and verdant plains of Hellas, and the fair blue skies overhanging the smooth Ionian Sea.

The deification of one or more great princes or rulers seems to have constituted the basis of the Scandinavian, as well as of every other pagan mythology. Odin, the supreme deity of the Scandinavians, and the ruler of heaven and earth, appears, like the Hellenic Jupiter, to have been a distinguished chief and warrior of early times. Although it is asserted by some that a divinity of the name of Odin was worshipped from the most remote ages, there is reason to believe that the worship of this personage, in the North at least, had its

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real origin a few centuries before the commencement of the Christian era, when a powerful chieftain of the name was driven by the Romans from his dominions between the Euxine and Caspian, and took refuge in Scandinavia, the whole of which he subjected to his sway. Like Mahomet, this chief appears to have established a new religion, of which he himself assumed to be the earthly head, as the servant or minister of a divine being of the same name. In the course of time, however, this distinction was entirely lost, and the persons and acts of the divine and earthly Odin became inextricably blended in the mythology and traditions of the North. The great records of the religious and legendary knowledge of the Scandinavians are the Eddas and Sagas, still preserved in Iceland, partly written in poetry and partly in prose. The oldest of the Eddas, a series of poetical fragments, was collected from oral tradition in the eleventh century, and the others are of later date. The acts of the deities and heroes of the North, the creation of the world, and prophetic revelations, form the general subject of these pieces.

Thor is described as the god of thunder, and the strongest of beings, earthly or heavenly. He is the son of Odin and Frigga, or, in other words, of the Sun and the Earth. When he moves, the earth trembles. He holds in his hand a powerful hammer, called the Crusher, with which he annihilates all who oppose him, and who offend the gods. In battle Thor is always girt with a magic girdle, which has the power of inspiring him with a divine fury, and redoubling his strength. On his right hand he wears an iron gauntlet, with which

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he grasps and wields the formidable Crusher. This latter instrument was forged by a dwarf, named Sindri, the prototype of the deformed blacksmith-deities of the Greeks, Vulcan and his Cyclops. The hammer possesses the wonderful power of never missing its aim, and, when launched at any object, returns to the hand of Thor, after having destroyed his foe. Thor is sometimes called Aukistor, or Thor of the Car, from his riding on a chariot, drawn by two powerful he-goats, named Sangniostr and Tangrisner. This deity has a spouse named Sipia, famous for her beautiful hair.

After Odin, Thor was the most cherished deity of Scandinavia, and had statues and temples erected to him everywhere. His statues were usually formed of clay, and represented a tall figure, with a red-painted beard, indicative of the lightning which he was supposed to wield. Bread and meat were supplied daily to the god by his worshippers, and at stated times libations were poured out in his honor.

Balder, the second son of Odin, was the most beautiful and amiable of the Aser, or gods. Unlike the rest of his brethren, he was fond of peace, and had the power of allaying tempests, and acting as a mediator, to avert divine wrath. His decrees were irrevocable. There were various other minor divinities in the Scandinavian mythology, though not nearly so many as in the Grecian roll. The deficiency was made up among the Northerns by the assignment of more multitudinous duties to the greater deities. Thus Odin, from the extent of his government, received as many as one hundred and twenty distinct names, each indicating some individual quality ascribed to him.

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The great hall appointed for the reception of the spirits of the brave, when they left earth for the seat of of the gods, was called Valhalla. Twelve beautiful yet terrible nymphs, named Valkyries, were the guides of the good spirits to the hall of Valhalla, and supplied them with mead. The occupation of drinking this Northern nectar, and of eating the fat of the wild boar, Serimner, which, after serving as the daily food of thousands, became whole again every night, filled up all those intervals of time in Valhalla that were not passed in fighting. None but those who had shown surpassing bravery on earth were admitted into this Scandinavian paradise, and when there, their daily amusement was to fight with one another till all or nearly all were cut in pieces. But little harm was done in this way, for the spiritual bodies soon reunited. and enabled the warriors to appear, entire in lithe and limb, at the feasts that followed these extraordinary engagements. The skulls of enemies were the drinking-cups used at the entertainments of Valhalla, and the guests are described as being almost perpetually in a state of inebriation. It was only when the cock announced the arrival of morning that these terrible heroes arose from table, to issue to the field of battle through the five hundred and forty gates of Valhalla, and hack each other to pieces anew. Such was the never-ending round of employment destined for the departed heroes of Scandinavia.

The mythology of the Scandinavians survived till a much later date than any other system of heathen worship in Europe. It was not abolished till the eleventh century.

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ANGLO-SAXON SUPERSTITIONS. — At a comparatively early era, the mythology and minor superstitions of the Scandinavians, as well as the follies of Druidism, disappeared in Britain as the familiar superstitions of the Anglo-Saxon race became predominant. Like the Scandinavians of the North, the Anglo-Saxons deduced their descent from Odin, whom they worshipped along with Thor, Freya, and other imaginary deities of the Gothic people. They also worshipped idols emblematic of the sun, moon, earth, and various seasons and circumstances. The Gothic nations, of whom the Anglo-Saxons were a branch, had various orders of elves, who were understood to haunt the fields, the woods, mountains, and waters, and received denominations accordingly, as field-elfin, dun-elfin, &c. Whether this varied race of spirits originated in the East, whence so many superstitions spread into Ancient Europe, is not satisfactorily known, although it is probable that they did, and were of the same genus as the *peri* of the Persians, a being not dissimilar in character to our fay, or fairy. Both in the Scandinavian and Anglo-Saxon superstitions, elves formed an important order of beings, not unlike in character to the demigods, naiads, driads, and other imaginary spirits of the Greek and Roman mythologies, and like them exerted a certain influence over human affairs.

Besides a belief in these mysterious elfin tribes, the Anglo-Saxons brought with them to England the still darker and more dangerous doctrines of witchcraft and divination, before which the reasoning powers of the people quailed, and all intellectual advancement was impeded. The general introduction of Christianity,

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about the year 600, abolished, as a matter of course, the more gross pagan observances, but failed to extirpate the familiar and less obvious superstitions of the people. Witchcraft, wizardry, magic, divination, preparations of charms, and other mystic follies having no foundation in truth, continued to flourish, although opposed both by the more intelligent clergy and the kings. It is from the statutes, indeed, which Alfred, Canute, and other monarchs, passed for the prevention of magical practices, that we chiefly know their nature and extent. *Wiglaer*, a wizard, and *wicca*, a witch, are persons severely denounced. Penalties are enjoined if any one should destroy another by *wicceraeft*. They appear to have used philters, for it is declared a crime in any one to use witchcraft, or potions to produce another's love. Canute enjoins his people not to worship fire or floods, wells or stones, or any sort of tree; not to frame death-spells, either by lot or otherwise; and not to effect any thing by phantoms. Wizards, we also learn, pretended to the power of letting loose tempests, and controlling the visible operations of nature.

FAIRIES. — Among the various supernatural beings to whom the ignorance and credulity of mankind have given an imaginary existence, the fairies occupy a prominent place, and are especially worthy of notice. The characters of different classes of spirits have become so mingled and confounded together in the lapse of time, that it is difficult to define individual species with correctness and precision; but there is one characteristic which appears to distinguish the fairy from every other being of a similar order. Most spirits could contract and diminish their bulk at will, but the fairy

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alone seems to have been regarded as essentially small in size. The majority of other spirits, also, such as dwarfs, brownies, and the like, are represented as deformed creatures, whereas the fairy has almost uniformly been described as a beautiful miniature of the human being, perfect in face and form. These points of distinction, with a dress of pure green, are the principal ones which mark the personal individuality of the fairies as a supernatural race.

The origin of the fairy superstition is ascribed by most writers to the Celtic people, but the blending of the Gothic tribes with the Celts led to the admixture of many attributes of the Northern spirits with those proper to the fairies. Thus, the latter race, which appears to have been intrinsically good and benevolent, has been gifted with attributes of the very opposite kind, borrowed from the trolls and elves of the North. In Scotland, and other countries where the Celtic traditions predominated, the fairies retained, in part, the original and better features of their character, and were usually called the Good Neighbours, or the Men of Peace; but even there, their character was deteriorated by a considerable leaven of elfin or dwarfish malignancy. This evil part of their nature caused much annoyance to mankind, and, more especially, their propensity to the kidnapping of human beings. Unchristened infants were chiefly liable to this calamity, but sometimes adult men and women were also carried off. They also kidnapped young married women to be nurses to their infants.

The necessity for the latter kind of kidnapping shows the fairies to have been *family* people. They

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are always represented as living, like mankind, in large societies, and under a monarchical form of government. The Salic law seems to have had no countenance among them, for we more often hear of fairy queens than of fairy kings, though both are frequently spoken of. The Land of Faërie was situated somewhere under ground, and there the royal fairies held their court. In their palaces all was beauty and splendor. Their pageants and processions were far more magnificent than any that Eastern sovereigns could get up, or poets devise. They rode upon milk-white steeds. Their dresses, of brilliant green, were rich beyond conception; and when they mingled in the dance, or moved in procession among the shady groves, or over the verdant lawns of earth, they were entertained with delicious music, such as mortal lips or hands never could emit or produce. At the same time, most of the legendary tales on the subject represent these splendors as shadowy and unsubstantial. When the eye of a seer, or any one gifted with supernatural powers, was turned upon the fairy pageantries or banquets, the illusion vanished.

Numberless stories of a ridiculous kind have been told relative to the intercourse of the fairies with mankind. Some of the poor creatures arraigned in Scotland, in past times, for witchcraft, admitted having had correspondence with the fairies. The trials of Bessie Dunlop and Alison Pearson, in the years 1576 and 1588, illustrate this statement. The former avowed that her familiar was one Thome Reid, the ghost of a soldier slain at Pinkie in 1547, and who after his death seems to have become an inmate of Elf-land.

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She related that this Thome Reid, who appeared frequently to her in the likeness of an elderly man, gray-coated and gray-bearded, wished her to go with him to the fairy country, and gave her herbs to cure various diseases. He even once brought to her the queen of the fairies, who, to the confusion of poetry, was a fat woman, fond of ale, and, in short, most unlike the Titania of romance. Alison Pearson also admitted her familiarity with the fairies, from whom she frequently received herbs for the cure of disease.

It may not be improper in this place to allude to the fancies of the poets on the subject of the fairies. Shakspeare stands preëminent in this department. His "Midsummer Night's Dream" is a poem of exquisite beauty, and one corresponding in every respect with the delicately fanciful nature of the subject. In "Romeo and Juliet," he has also described an important fairy, Queen Mab, who has almost dethroned Titania of late years. Mr. Tennant's "Anster Fair" has been of great avail to the fame of Mab. Whoever chooses to consult Drayton and the poets mentioned, will have the pleasure of observing and enjoying the exercise of poetical fancy of the highest order on the subject of fairies.

The superstitions now described are not yet extinct in the British Islands. In Ireland, the Scottish Highlands, and Wales, in particular, the fairies are yet objects of general belief. Education has not yet shed its enlightening influence there, and by education alone can the darkness of superstition be dispelled. This is almost a truism, for superstition and ignorance are nothing else than equivalent terms. The spirit is abroad,

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however, which will extinguish this remnant of barbarism, and it is consoling to think so, for the ills which have flowed from this source are numberless.

WITCHCRAFT. — An old writer, speaking of the powers of witches, says, — "1. Some work their bewitchings only by way of invocation or imprecation. They wish it, or will it; and so it falls out. 2. Some, by way of emissary, sending out their imps, or familiars, to crosse the way, justle, affront, flash in the face, barke, howle, bite, scratch, or otherwise infest. 3. Some by inspecting, or looking on, or to glare, or peep at with an envious and evil eye. 4. Some by a hollow muttering or mumbling. 5. Some by breathing and blowing on. 6. Some by cursing and banning. 7. Some by blessing and praising. 8. Some revengefully, by occasion of ill turnes. 9. Some ingratefully, and by occasion of good turnes. 10. Some by leaving something of theirs in your house. 11. Some by getting something of yours into their house. 12. Some have a more speciall way of working by severall elements, — earth, water, ayre, or fire. But who can tell all the manner of wayes of a witch's working; that works not only darkly and closely, but variously and versatilly, as God will permit, the devil can suggest, or the malicious hag devise to put in practice?"

In the present age of comparative intelligence, it is difficult to understand how human beings could be so deplorably ignorant as to entertain such a gross superstition. We must, however, recollect that the belief was greatly fostered by religious impressions, and that it was long considered a mark of impiety to doubt

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the existence of witches. Various other circumstances helped to cherish and magnify the error.

The superstition seems to have approached its height about the end of the fifteenth century. In his bull of 1484, Pope Innocent charged inquisitors and others to discover and destroy all such as were guilty of witchcraft. This commission was put into the hands of a wretch called Sprenger, with directions that it should be put in force to its fullest extent. Immediately there followed a regular form of process and trial for suspected witches, entitled *Malleus Maleficarum*, or a Hammer for Witches, upon which all judges were called scrupulously to act. The edict of 1484 was subsequently enforced by a bull of Alexander the Sixth, in 1494, of Leo the Tenth, in 1521, and of Adrian the Sixth, in 1522, each adding strength to its predecessor, and the whole serving to increase the agitation of the public mind upon the subject. The results were dreadful. A panic fear of witchcraft took possession of society. Every one was at the mercy of his neighbour. If any one felt an unaccountable illness, or a peculiar pain in any part of his body, or suffered any misfortune in his family or affairs, or if a storm arose and committed any damage by sea or land, or if any cattle died suddenly, or, in short, if any event, circumstance, or thing occurred out of the ordinary routine of daily experience, the cause of it was witchcraft. To be accused was to be doomed, for it rarely happened that proof was wanting, or that condemnation was not followed by execution. Armed with the *Malleus Maleficarum*, the judge had no difficulty in finding reasons for sending the most innocent to the stake.

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If the accused did not at once confess, they were ordered to be shaved and closely examined for the discovery of devil's marks; it being a tenet in the delusion that the devil, on inaugurating any witch, impressed certain marks on her person; and if any strange mark was discovered, there remained no longer any doubt of the party's guilt. Failing this kind of evidence, torture was applied, and this seldom failed to extort the desired confession from the unhappy victim. A large proportion of the accused witches, in order to avoid these preliminary horrors, confessed the crime in any terms which were dictated to them, and were forthwith led to execution. Other witches, as has been said, seemed to confess voluntarily, being probably either insane persons, or feeble-minded beings, whose reason had been distorted by brooding over the popular witchcraft code. A few extracts from the work of Dr. Hutchinson will show the extent of these proceedings in Italy: —

"A. D. 1485. — Cumanas, an inquisitor, burnt forty-one poor women for witches, in the county of Burlia, in one year. He caused them to be shaven first, that they may be searched for marks. He continued the prosecutions in the year following, and many fled out of the country.

"About this time, Alciat, a famous lawyer, in his *Parergu*, says, 'One inquisitor burnt a hundred in Piedmont, and proceeded daily to burn more, till the people rose against the inquisitor, and chased him out of the country.'

"A. D. 1488. — A violent tempest of thunder and lightning in Constance destroyed the corn for four

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leagues round. The people accused one Anne Mindelin, and one Agnes, for being the cause of it. They confessed, and were burnt.

"About this time, H. Institor says, one of the inquisitors came to a certain town, that was almost desolate with plague and famine. The report went, that a certain woman, buried not long before, was eating up her winding-sheet, and that the plague would not cease till she had made an end of it. This matter being taken into consideration, Scultetus, with the chief magistrate of the city, opened the grave, and found that she had indeed swallowed and devoured one half of her winding-sheet. Scultetus, moved with horror at the thing, drew out his sword, and cut off her head, and threw it into a ditch, and immediately the plague ceased! and, the inquisition sitting upon the case, it was found that she had long been a reputed witch.

"A. D. 1524. — About this time a thousand were burned in one year, in the diocese of Como, and a hundred per annum for several years together."

From other authorities it is learned that the devastation was as great in Spain, France, and Northern Germany, as it was in the Italian States. About the year 1515, five hundred witches were burned in Geneva in three months, and in France many thousands.

In Germany, to which, indeed, the bull of Innocent bore particular reference, this plague raged to a degree almost inconceivable. Bainberg, Paderborn, Wurtzberg, and Treves were its chief seats, though for a century and a half after the introduction of the trials under the commission, no quarter of that great empire was free from its baneful influence. It has been esti-

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mated that 100,000 persons were executed in Germany during this delusion.

Nor were the more enlightened parts of Europe less afflicted by this fearful mania. It raged in Scotland, and it is estimated that four thousand persons became its victims. In England it occupied the attention of the gravest persons. In the time of Henry the Eighth, two acts were levelled against witches and conjurors, and from this period down to 1751, when the last execution took place in the person of a woman by the name of Osborn, who was so injured by the mob as to die soon after, several thousands were executed for this imaginary and impossible crime! How serious the lesson which this point of history enforces upon mankind, — for Catholics and Protestants, — kings, lords, and commons, — the learned and the illiterate, — were all involved in the illusion, and became parties to its atrocities. Nor was New England, the land of the Pilgrims, free from the infection, as the well known records of Salem and Danvers can tell.*

Spectral Illusions, or Ghosts, &c. — The subject of spectral illusions, or, to use the common phraseology, apparitions or spectres, is now, in the estimation of scientific and properly informed men, one of the simplest and most intelligible to which the mind can be directed; while, to the ignorant, it still appears full of doubt and mystery. An apparition, spectre, ghost, or whatever it may be called, is vulgarly supposed to be a supernatural appearance, — a thing

* For an account of witchcraft in New England, see "Lights and Shadows of American History."

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occurring out of the common order of nature. No particular time or place is assigned for the appearance; but we may observe that the time is usually evening or night, and the place solitary, or apart from the busy haunts of man. According to old theories on the subject, the person who declared that he had seen such an appearance was either set down as the fabricator of an untruth, or his story was fondly believed, and in the latter case the supernatural incident was added to the mass of credible history. It is more easy to set this conflict of testimony and opinion to rights. In all cases, it is quite possible for the declarant to speak the truth as respects what he saw, or thought he saw, and yet that no real apparition may have occurred. The whole affair, is simply a mental delusion, caused by some species of disease in the organs which affect the vision. Yet the belief in ghosts and apparitions has been almost universal, and even Dr. Johnson was a firm advocate of their reality.

Second-Sight. — Second-sight, taking the word in its common acceptation of supernatural sight-seeing, is one of the varieties of spectral illusion. Certain mental functions becoming diseased, the sense of sight is imposed upon by the appearance of things which are purely imaginary, but nevertheless supposed to be prophetic of future events. Idleness, solitude, insufficient diet, and an imagination led astray by ruminating too intensely on the causes of human weal and woe, may be assigned as the prevailing causes of the disease. The Lowland Scotch used occasionally to see *wraiths*, or spectral appearances of persons who were soon to quit this mortal scene; the Irish were also

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accustomed to the spectacle of *fetches;* and the Highlanders had their *second-sight*, — the whole, be it observed, being but a variety of the same mental disease and delusion.

Second-sight, however, has formed the subject of a more regular profession than any other species of spectral frenzy. There were persons, who, possessing from infancy a defective mental constitution, or having a taste for imposture, gave themselves out as habitual sight-seers, and were reverenced accordingly by their unsophisticated neighbours. According to the credulous accounts of second-sight, the power of the seer is a natural endowment, and cannot be acquired by communication, or in any other way. It is usually talked of by its possessors as a painful and troublesome gift, and one which they would gladly be rid of, if they could. Its vaticinations relate only to things to come, and not to past events. Young and old may alike possess the second-sight, and it is common, also, to men and women. The visions are sometimes predicative of good, and sometimes of evil. Occasionally, the vision simply gives indifferent tidings.

Miscellaneous Superstitions.— During the seventeenth century, the belief in witchcraft, fairies, apparitions, charms, and every other species of supernatural agency, was still universal in Britain, both among high and low, clergy as well as laity. So ill instructed were the people in the art of tracing events to simple natural causes, that there appears to have been a continual liability to ascribe occurrences to the direct influence of good or evil spirits, but particularly to the Devil. "Give me leave," says a respectable writer of that

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age, "here to relate a passage, which I received from a person of quality, namely: — It was believed, and that not without good cause, that Cromwell, the same morning that he defeated the king's army at Worcester fight, had conference personally with the Devil, with whom he made a contract, that to have his will then, and in all things else, for seven years after that time (being the 3d of September, 1651), he should, at the expiration of the said years, have him at his command, to do at his pleasure, both with his soul and body. Now, if any one will please to reckon from the 3d of September, 1651, till the 3d of September, 1658, he shall find it to a day just seven years, and no more, at the end whereof he died; but with such extremity of tempestuous weather, that was by all men judged to be prodigious." Such is a specimen of the egregious fallacies which passed for sound argument among our ancestors.

In Scotland, where religion assumed the garb of gloom and fanaticism, a belief in the personal appearance of devils was universal in the seventeenth century, and continued among the vulgar till within the last fifty years. The narrations of Satan's mean pranks, in assaulting ministers, waylaying travellers, and disturbing families while at worship, would fill a large volume. In the Rev. Mr. Robert Law's "Memorials of Memorable Things, from 1638 to 1684," we find the following entry: —

"October, 1670. — There was a devill that troubled a house in Keppoch, within a mile of Glasgow, for the matter of eight days tyme (but disappeared again), in casting pots, and dropping stones from the roof, yet

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not hurting any, like that which appeared in the West, in a weaver's house, a good man, about fourteen yeirs agoe, which did the lyke, and spoke to them audibly." The tricks of the devil here referred to as having taken place in a weaver's house in the West, about the year 1656, and which were implicitly believed by the most learned clergy of the time, are related at great length by Mr. George Sinclair, Professor of Philosphy in the College of Glasgow, in his work, "Satan's Invisible World Discovered."

Besides the belief in aerial and terrestrial spirits, our credulous ancestors put faith in all kinds of romancing stories of river and sea demons. The more prevalent of these superstitious notions was a belief in mermaids and mermen, a class of creatures who lived in the sea, and had bodies half human, half fish. Mermaids appear to have been much more common than mermen. The mermaid, we are told, possessed the body, from the middle upwards, of a beautiful female, with a head flowing with long, yellow hair, which she incessantly combed with one hand, while she held a small mirror with the other. This female monster of the deep is described as having been a constant schemer of destruction to confiding navigators, or those who haunted unfrequented parts of the sea-shores.

Another of the vulgar superstitions of our ancestors was a belief common to nations of Germanic origin, that the corpse of a murdered person would bleed on being touched by the person who was guilty of the murder. Strange to say, this species of evidence of guilt was at one time admitted in the Scottish criminal courts. The following extraordinary instance was com-

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municated to Sir Walter Scott, and is given in his "Minstrelsy of the Scottish Border." "Two young men, going a-fishing in the River Yarrow, fell out, and so high ran the quarrel, that the one, in a passion, stabbed the other to the heart. Astonished at the rash act, he hesitated whether to fly, to give himself up to justice, or conceal the crime; and in the end fixed on the latter expedient, burying the body of his friend very deep in the sands. As the meeting had been accidental, he was never suspected, although a visible change was observed in his behaviour, from gayety to a settled melancholy. Time passed on for the space of fifty years, when a smith, fishing near the same place, discovered an uncommon and curious bone, which he put in his pocket, and afterwards showed to some people in his smithy. The murderer being present, now an old, white-headed man, leaning on his staff, desired a sight of the little bone; but how horrible was the issue! — no sooner had he touched it, than it streamed with purple blood. Being told where it was found, he confessed the crime, was condemned, but was prevented by death from suffering the punishment due to his crime." We need only add, that no evidence is given of the truth of this improbable tale, and it is utterly unworthy of belief.

The occurrence, in 1840, of a fatal disease in cattle, called the *murrain*, and which was susceptible of remedy by proper surgical means, led to the exposure of various superstitious observances among a respectable class of the rural population of England. In Northumberland, a fire kindled by rubbing together two pieces of hard wood was carried about in an old

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shoe from one house to another, and thus passed through the country; with this a bonfire was lighted, and the cattle were made to pass through its smoke, which was supposed to render them invulnerable to the attacks of the disease.

In Scotland, cattle are the subject of scarcely less superstitious maxims. In many districts, if a cow has been seized with *phthisis pulmonalis*, or any inflammatory disorder, or if she has become *hide-bound*, or rumination has been accidentally stopped, the wise people called in to minister know but one explication of the mystery: the beast has got the *tail-ill*. This is an imaginary disorder supposed to reside in the tail, and to show itself by eating away the bone of that organ. To prove its presence, the cow-doctor will ask the owner of the animal to feel the tail near its extremity, and satisfy himself that the bone is "clean awa'," the fact being that in that region there is only a soft cartilage. Under this miserable delusion, the people make incisions in the tails of cattle, into which they rub salt, soot, or horse-turpentine, thus adding to the pains of the animal, without doing the least for the relief of the real malady. Often a considerable portion of the tail is cut off, by way of making the cure more certain. In some cow-houses in Scotland, there is not a cow with a tail above sixteen inches long.

It would be easy to extend this list of superstitions, nor should we be obliged to go beyond our own vicinity to cite cases as absurd as those we have drawn from foreign countries. In respect to religion, some curious instances of delusion have recently been manifested in the United States, and have involved multi-

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tudes of persons enjoying the highest advantages of intellectual and moral light in their bewildering fascinations. A few years since, a man by the name of Miller announced that he had deciphered the prophecies of the Old Testament, foretelling the doom of the human race and the end of the world; and that their fulfilment was to take place a particular day in March, 1843. His preaching attracted vast crowds, and produced great excitement, in various parts of New England, and even in other States. A sect was soon formed, a newspaper established, books of worship prepared, and a large edifice in Boston, called the Tabernacle, was constructed for the accommodation of the worshippers. The belief of the reality of the coming destruction was ardently embraced by thousands; and some prepared their white robes in which they were to ascend to heaven, of course leaving the wicked behind to be consumed; hundreds closed their offices; and multitudes left off work and gave themselves up to religious contemplations; and many gave their property into the common stock, to be used till the appointed consummation, when it would be no further needed.

The subjects of this strange delusion — looking with pitying contempt upon the unbelieving world — waited for the day of doom; but, instead of the tempest and the fire and the whirlwind, it brought a serene sky and a tranquil atmosphere. The time passed by, — but the illusion had taken a firm hold of the minds of the Millerites; or, if this was shaken, their pride was enlisted on the side of the destruction of the world. They even seemed chagrined that the awful conflagration had not taken place, and, as if determined that it

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should come, at all events, they assembled in crowds, praying and wailing, day and night. Their leaders even fixed another and another day, and it was not till the events had several times belied these profane and audacious predictions, that the illusion began to fade from the minds of its unhappy victims. Even now, many hold on to the belief they have adopted, it being only modified by supposing that, while the precise hour is not yet revealed, the time of the great catastrophe is near at hand.

There is a still more humiliating instance of popular delusion to be recorded in the history of our own times. A man by the name of Joseph Smith, a native of Vermont, pretended, some fifteen years ago, to have discovered certain brass plates, which had lain for a long period in the eastern parts of the State of New York, and which he intimated were brought thither by the descendants of the Jews. Upon them he discerned certain mystical inscriptions, which, by the inspiration of God, he was enabled to translate. This revelation he entitled the "Book of Mormon." Thus began the modern sect of the Mormons, which now numbers in its ranks some thousands, and has its churches not only in several of our States, but in Great Britain!

Smith continued to be the head and prophet of the new religion; and though his life was marked with the coarsest vices, and the most vulgar eccentricities, the "Latter Day Saints" continued to increase, and the city of Nauvoo, in Illinois, which is the Mecca of the faithful, has become a large and flourishing city. The following is a recent description of this remarkable place:—

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"The city limits are four miles long and three in breadth. At the end of three years from its establishment, it contained one thousand houses, chiefly white-washed log cabins, with a few framed and brick houses. The public buildings are the Nauvoo House, a spacious hotel, fronting on two streets, one hundred and twenty feet on each, forty feet wide, and three stories high above the basement. In this building, Joe Smith, the pretended prophet and leader of these Latter Day Saints, is furnished with a suite of rooms. The *Nauvoo Temple*, not yet completed, will be one hundred and thirty feet long, and one hundred feet wide. In the basement is a baptistery, supported on twelve gilded oxen, the model of which is derived from the brazen sea of Solomon. The *Nauvoo legion* consists of from two thousand to three thousand men, with proper officers, armed and disciplined. They have a *university*, which has a president, a professor of mathematics and English literature, a professor of the learned languages, and a professor of church history. The city is laid out with streets of ample width, crossing each other at right angles. This property is held as private; but they have a large farm without the city, which is occupied and cultivated in common. The population within the city limits is about seven thousand, many of whom are from England, besides about three thousand of the fraternity, who reside in the vicinity. The city has a mayor, and is divided into four wards, having two aldermen, four common-councilmen, and a constable for each of the wards. The city is a curiosity, and the success of its leader has scarcely been paralleled since that of the prophet of Arabia."

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In 1844, Smith was taken, upon some charge, by the civil magistrates of Illinois, and while in custody he was shot by some persons in disguise. He fell, pierced with several balls; but his spirit seems still to dwell with the church he has founded, and no one can tell how long the bald and barefaced cheat he has imposed upon the world may continue to lead his followers into captivity to sin and death.

These, and other similar instances in which human history abounds, are sufficient to warn mankind that enemies without and enemies within make a large part of the human race the slaves of folly and delusion. It does not abate our mortification, when we look upon the world, to know, that of all delusions the most common and the most fatal is self-deception. What a mystery, — what a paradox, — that mankind should seriously set about cheating themselves. Yet this will be found to be a large ingredient in most of the delusions found in the earth!

MANIAS. — As there are many instances on record in which the bodies of men have been afflicted by epidemic diseases, so there are many in which their minds have been affected by pervading delusions. As the horses of the West are said to be sometimes beset with a *stampede*, so human society is often carried away by manias. This species of madness manifests itself on all kinds of subjects, but in none are its tricks more fantastic than in relation to money speculations. The operations among ourselves, in 1836, in respect to Eastern lands, afford a striking instance of this sort. The "Mississippi Scheme,"* and the "South Sea

* For an account of the "Mississippi Scheme," see article *John Law*, in "Curiosities of Human Nature;" and for an ac-

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Bubble," are also notable examples of the same kind. The "Tulip Mania," which took place in Holland, about the year 1635, is less generally known, while it still more strikingly illustrates the tendency of mankind to this species of illusion.

The tulip was introduced from Constantinople into France and Holland early in the seventeenth century. In the latter country great attention was paid to its cultivation, and, in the year 1634, most extraordinary speculations were entered into with respect to the roots of these plants. These were sold and resold at enormous prices, in the same manner as public stocks are at the present day. The value of the bulbs lay in the passion for them that raged in the community, and particular kinds were so much esteemed, that a single root of one species was sometimes sold at the enormous price of a thousand dollars.

After the speculation began, it raged for three or four years. A single root of the species called Semper Augustus was often sold at the price of eight hundred dollars. It once happened that only two bulbs of this kind were to be had. One was sold for nine hundred dollars, a new carriage, a pair of horses and the harness; and the other for twelve acres of land. Every body entered into these speculations; noblemen, merchants, mechanics, seamen, farmers, turf-diggers, chimney-sweeps, maidservants, and old-clothes women. In every town, the tavern was a sort of Exchange where these transactions were carried on. It was not necessary in the height of the mania to produce the bulbs; but bonds were given for imaginary roots, and

count of the "South Sea Bubble," see "Lights and Shadows of European History."

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these were bought and sold to an immense amount. While the prices continued to rise, every body grew rich. Many in humble circumstances made fortunes in the course of a few months. We are told that not less than ten millions of florins were expended in three years during this excitement in Holland. The government at last interfered to check these speculations, and the bubble burst as suddenly as it had been called into existence.

WAR.

Among the great errors of man, is that of war, — the art of mutual killing. "Thou shalt not kill" is one of the great commandments; and a single death, inflicted by a malignant hand, bears that thrilling, appalling name, — murder! This is a crime so fearful that it is said no human bosom, — not even the grave, — can hide it. Yet national murder, — murder by authority, by wholesale, — selfish, malignant killing of thousands, — nay, millions, — is glorious, heroic war! How familiar, how fascinating, has this become to us. War is celebrated in the stanzas of Homer, and by every great poet since his time. What is there in the pageantry of this world so gorgeous, so imposing, as the martial array; what so inspiring as the bugle note, or the pealing drum and fife? Who has not felt his enthusiasm rise, as he has read the glowing tale of battles, handed down by the historian and the poet, and who has not felt his heart beat with an ardent wish to mingle in the glorious fray!

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Yet this is, after all, but murder; it is a selfish killing of our fellow-men. How is it, then, that our minds have become so warped, our moral vision so distorted, that we gloss over a deadly crime, and regard it with admiring enthusiasm? The history of mankind can alone solve the mystery; kings and princes have set the evil example; the adulations of poets and historians have given a false gloss to their deeds, and the supple mind of man has yielded to the fearful delusion. Let us hope that the day is drawing near when this great error shall be viewed in its proper light. Providence is teaching the nations by examples, that unjust wars, even of the strong against the weak, are expensive enterprises. It cost the United States forty millions of dollars, and thousands of valuable lives, to conquer one thousand Seminole warriors. It has cost the French sixty-five thousand lives, and seventy-five millions of dollars, to obtain a barren and profitless dominion over Algeria! It cost Britain millions of pounds sterling, and rivers of blood, to send her armies to Afghanistan, and back again! How much good the treasures expended upon these barbarous and needless wars might have done, if expended in charity, or even in the common business of life, — to say nothing of the lives lost, the misery endured, the crimes committed, the sins perpetrated before God and man, in such measures of grasping ambition.

Let us hope that a better feeling and a wiser policy is beginning to take possession of even the breasts of statesmen and princes. One thing is certain: the mass of the people are by degrees learning to appreciate peace; they see that war may be glorious to gen-

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erals and leaders, who even in the camp are surrounded with luxuries, and run little risk of life, while it implies every species of privation, degradation, wounds, and death, to the poor soldier. We are informed that in England the friends of peace have recently resorted to a novel but effectual method of checking the wicked custom of war. In those places to which the officers of the government are sent to obtain recruits for the army, the opponents of human butchery post at the corners of the streets and at other public places placards like the following, displayed in large letters, so as to attract universal attention.

"Wanted several thousand able-bodied men, to shoot or to be shot at!! or perish miserably by thirst and starvation on the plains of India. — *Nota Bene!!* The Duke of Wellington says that no one who entertains nice scruples about religion has any business in the army. None such need apply."

It is said that thousands, tempted by poverty and discouragement, have by this means been deterred from enlisting in the army, and that the government's officials have been thereby put to their wits' end in hunting up recruits. Heaven speed the day when not a man can be found willing to fight the bloody and disgraceful battles by which the governments of the earth are prone to scourge their unfortunate subjects!

INTOXICATING DRINKS AND DRUGS.

THERE is another practice of mankind even more fatal than that which we have been considering. If

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war has slain its thousands, intoxicating drinks and drugs have slain their ten thousands. This strange practice of self-destruction among men may deserve particular notice.

We know that, in all ages and countries, it has been a practice of mankind to seek what is termed a genial excitement of the nervous system, by intoxicating drugs and liquors. Wine was one of the earliest of human inventions, and in its use seems to have kept pace, for ages, with the progress of civilization. Other fermented liquors, as ciders, the palm-wine of Africa, the *pulque* of Mexico, ale, porter, and beer, in various forms, have been the devices for producing the desired and cherished intoxication. Distilled liquors, such as rum, brandy, gin, whisky, &c., are all of comparatively modern origin; but they have been, and still are, the potent charm by which the incantation is to be performed.

In a rude state of society, when war was the great game of the master spirits of mankind, when the chief pleasures and occupations of life were of a coarse, physical, and voluptuous nature, the excitement produced by wine was not calculated to shock the moral sense of the world. Even if men became drunk, furious, frenzied, — if brawls arose, and blood flowed, under the excitement, — there was nothing incompatible with the tastes of the time. Among men accustomed to scenes of violence, to the bloody strife and ghastly spectacles of the battle-field, the drunken brawl was rather a gay excitement than a revolting and brutal revel. .

We can see, therefore, what would otherwise seem

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strange, how it was that this practice of intoxication wove itself like a web of steel over civilized society. The early poets looked upon the excitement produced by wine as a kind of inspiration, and therefore they attributed its invention to their gods. The Egyptians imputed it to Bacchus, and the Greeks to Saturn, — beings whom they worshipped as divinities.

The drinking of wine, therefore, was sanctioned by Heaven, and drunkenness was patronized by the gods. A sad illustration this of the degradation of human nature, when left to itself, without the elevating influence of revelation. Yet it is only in keeping with all history, which always shows man, when inventing a religion for himself, as first imputing his own vices to the deity, and then practising them under this divine sanction.

Thus, in Egypt, Greece, and Rome, the gods of drunkenness had their temples, their priests, their altars, and their sacrifices; and consequently every species of debauch was practised under the sanction of religion. It could not be expected that the morality of society would rise above the standard of the priesthood and the altar, and thus the practice of intoxication extended over the whole mass. At the festive board, wine was introduced, and the first glass, the solemn libation, was poured out to the gods. It could not be expected that the people would be sober, when the deity set such an example. The wine flowed freely. The poet was there, and, as he became mellowed, he sang the praises of Bacchus, and depicted in glowing colors the genial influences of his inspiration. The musician was there, and he gave efficacy to the

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spell, by his enchanting melodies. Beauty was there, and lent its bewitching charms to the bewildering yet joyous madness.

Such was the scene of festivity in ancient days, and nothing can exceed the force with which some of the old poets have depicted the mad delights of these bacchanalian revels. Some of the finest poetry that antiquity has bequeathed us is devoted to the praise of wine.

By degrees, the use of this intoxicating liquor was introduced into the house and the home, and became blended with the most interesting and affecting incidents of life. It was used at the wedding and the funeral; at the birth and the baptism; at the common meal and the festive board; at court and at camp; at celebrations and triumphs. On all occasions, when the heart was softened, elevated, expanded, — there also was the intoxicating element, to cast its spell, and weave its web, over the body and the soul. Wherever the sons of men gathered together, there Satan, in this guise, came among them.

Thus it was that the use of intoxicating liquors became nearly universal. Mahomet, indeed, seeing its evil consequences, forbade the use of wine to his followers, and thus, for centuries, temperance was one of the leading traits of his disciples. In modern times, the Mussulman practice has relaxed, and wine, brandy, and arrack are extensively used in the East; when these are not taken, opium is employed to satisfy the craving of a sensual and voluptuous people for animal excitement.

In Christian countries, the progress of the intoxi-

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cating spell received no such religious check. The Europeans cultivated Greek and Roman literature, and adopted Greek and Roman customs. While they rejected statues and temples, they still maintained the worship of certain heathen deities. Though Bacchus had no formal priesthood, he had an altar in every house, and at every fireside. With the progress of the arts, a new discovery was made, — that of alcohol; and though this for a time was confined to the apothecary's shop, it at last emerged from its obscurity, and became the leader in the mighty movement of ruin and degradation.

From this period, intemperance rapidly spread over Christendom, extending its sway, multiplying its devotees, and marking its course by deeper traces of devastation, desolation, and death. It is remarkable, that, when the dawn of civilization was about to arise upon the world, after that long, gloomy night, called the Dark Ages, — when all the political and moral elements were at work to produce a bright sunrise upon mankind, — that even then a large mass of Christendom should have continued the besotted worshippers of this moral Moloch, *intoxicating drink*.

Time went on; revolution followed revolution; the great Reformation was achieved, and the mental fetters of Popedom were broken; the mind of Christian man walked forth, for the first time, at liberty to worship God according to its choice; the despotisms of Europe were gradually softened; the American Revolution broke upon the world, and disclosed some wonderful political truths; the French Revolution came, and, amid the darkness and the tempest, there were deep, broad, abiding flashes of light.

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Still time and change went on; the arts flourished; science was advanced; the missionary cause arose, and carried the gospel to far heathen lands and the remote islands of the sea. A thousand new and beautiful charities sprang up; men associated themselves together to scatter abroad the Bible, to disseminate useful truths, to cultivate doctrines of peace, to break the fetters of the slave. Every great moral reform had a champion save one, — the temperance reform.

It is amazing that this should have been the very last of the great moral movements for the regeneration of mankind, — this which should have been among the first. The reason we can easily understand. When, some thirty years ago, temperance societies were first suggested, they were generally ridiculed as chimerical and Quixotic. Even the reverend clergy, forward as they generally are in every good word and work, were here staggered. When they looked the formidable monster in the face which it was necessary to assail, they shrunk back with fear and dismay.

It was indeed a stupendous task that was proposed, — to attack one of the most cherished customs of society; to drive out of use one of the chief articles of commerce; to change the fashion of the civilized world. Yet a few men, who looked beyond their day and generation, undertook the fearful work. Amid ridicule, abuse, persecution, slander, and bitter spite, they pursued their way, until at last the light began to burst through the darkness, and the astonished world to gaze upon the startling and fearful revelation.

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The real character of the cause of intemperance has not been till lately understood; and we may present it as one of the benefits of the temperance movement, in its various forms, that the truth on this subject has been made manifest. We should never have known, but for this, that the use of alcoholic beverages is the most fruitful source of human woe and human degradation. It was left for the despised, traduced, scoffed-at temperance societies to lift the veil from the minds of mankind, and open the prison-door of human prejudice. It is to them we are indebted for the disclosure of the fact, that alcohol, in its multitudinous forms, is the chief cause of poverty; the chief cause of crime; the chief means by which the madhouse is filled; by which the prison is tenanted; by which the gallows is fed; by which ignorance is perpetuated; by which Christianity is retarded; by which civilization is kept back. These things have been made manifest, and set in order before the world, by the temperance cause. The whole need not a physician, but those who are sick. The first step toward reform is a conviction of the nature and extent of the abuse to be remedied. The Bedlamite, who was asked why he was confined, replied, "I thought all the world mad, and they all thought me mad. I was right, but the world outvoted me." Mere power in moral movement is vain; the patient must be convinced that he is sick, before he will call the physician, or take the remedy prescribed. You cannot treat the moral agent as a madman; or if you do, while incarcerated he will cling to his insanity. He will hold himself to be right, and all the world wrong.

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Hence the importance of these statistics — these stubborn facts — established and circulated by the temperance cause. Here is the great lever and fulcrum of this reform, and it is already beginning to shake the whole civilized world by these means. But this is not all it has done. The practical fruits are visible to every eye, and we are surrounded by speaking witnesses to the beneficent nature of the temperance movement.

If we extend our view, we shall observe that what has been done by the temperance cause here has been done elsewhere. On all hands, the results are the same. If the miracles of ancient days are not witnessed, if the blind do not see, the dumb speak, the lame rise up and walk, those who were lost are found, those who were condemned are redeemed. In all modern time, a more beautiful, a more miraculous discovery has not been made, than that which lies at the foundation of the Washingtonian movement. A few humble men — as if inspired by Him who was born in a manger, as if touched with his deep and affecting declaration, that "there is more joy in heaven over one sinner that repenteth than over the ninety-and-nine who never went astray" — determined to set about the reformation of the degraded, the depraved, the lost. How hopeless a task did this at first seem; to redeem the drunkard; to conquer his vicious propensities; to remove the stain upon his reputation; to wipe out his consciousness of degradation; to renew his jaded faculties; to restore him to society! This might seem a miracle indeed; yet it was undertaken, — it was attempted, — it has succeeded. Thousands — millions we may say — of living witnesses, in this and other lands, can bear testimony to the fact.

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How often, as well in the page of romance as that of history, have we been touched with the story of the long incarcerated prisoner, at last released, and restored to friendship and love; of the war-worn soldier, weary, wasted, mutilated, but at last returned to his home and his family; of the sailor, his voyage over, his dangers past, reposing at the fireside of his youth. How often have we wept with joy at even the fictitious tale of troubles past, of difficulties surmounted, of sorrows happily ended. But what tale of romance can equal the thrilling realities which the cause of temperance has produced?

A few years since, the drunkard was regarded as lost. This was even the doctrine of the temperance societies. The hope of redemption for such was not then born. It had not then been dreamed that there was balm, even in Gilead, for him. But a new star has arisen in the east; Christianity has had a new development; a new and glorious truth has burst upon the world. There is hope for the lost; there is balm in Gilead; there is redemption for the inebriate. Though fallen, he is still a man; though he has wandered, he may return to his house and his home. Though a husband, he may once more be united in the love and esteem of his wife; though a father, he may again embrace, in hope and confidence, his children; though a child, he may be restored, and bless the parental bosom he has torn with agony!

It would be easy to draw pictures even more touching than these; — yet not pictures, but portraits, — paintings of realities, histories full of truth and meaning. How often have we read with delight the story of some good action, — of a life saved, of sorrow appeased,

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of evil mitigated. The beautiful passages of history, as well as romance, are made up of elements like these; and yet, where is there a record that displays so much of practical charity, so much of productive benevolence, so much of efficient, fruitful Christianity, as that of the Washingtonian Society, in the compass of a few brief years. The tale of the Good Samaritan has lived for almost twenty centuries, and has been an example to all subsequent ages. Yet the cause of which we speak has not merely bound up the wounds of the flesh of one man; it has restored peace to the spirit, — it has healed the broken heart, the crushed bosom, the agonized soul of thousands.

We have not space to present in detail the economical advantages realized and proposed by the temperance cause. We all know, that, while ardent spirits are one of the chief sources of human evil, they are, at the same time, the most expensive of all luxuries. The simple truth is, that mankind waste more money upon this folly, — this self-destroying practice of rum-drinking, — than would be required to remedy all the poverty, sustain all the hospitals, keep up all the religious missions, and give education to every child throughout Christendom. Is it not evident that Christian statesmen ought not by any means to overlook this subject, viewed as a mere question of political economy? We observe throughout society a deep and anxious conviction that something is yet to be done to remedy the inequality of condition which we see in the world, and especially in foreign countries. There, society is divided into the pampered rich and the suffering poor. Whence come these things? Why is the world thus out of joint? These queries have disturbed

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many thinking heads, and a remedy for the evil has been sought in projects for a new organization of society. Many such have been proposed. They will, doubtless, fail of their object, — and all would be rendered useless and needless, if every working-man throughout the world would sign the pledge and abide by it. The evils alluded to find their chief source in the use of intoxicating drinks. The cost of these drains the pockets of the working classes; the liquor muddles their brains, and makes them fit to be the dupes of despots; it weakens their bodies, breaks their ambition, bends the neck of independence, and makes the stern yoke of authority sit easy to the servile neck. The working classes are the masters of the world, if they choose to be so. Liquor is the chief obstacle to the assertion of their rights and the maintenance of their power; liquor is the despot that degrades and enslaves them. Till this is dethroned, they cannot reach their true position, for a few clear heads may master a million of muddled tipplers. As a mere question of wise human policy, we believe, therefore, that the temperance cause claims the attention and support of the statesman, the friend of man, the lover of human rights and human liberty. Instead of being deemed the mere chimera of a few heated fanatics, — a thing to blaze and burn and go out, — it should rather be regarded as the beginning of a great revolution, which reaches to the foundation of society; the lever of Archimedes, which is to move the moral world. Without at least such a reform as this proposes, all others are vain, and, with it, others would come of course, or at least more speedily and more effectually.

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PAST AND PRESENT STATE OF THE WORLD.*

THE history of man begins at a point almost six thousand years ago. The great events since that period — those which have exercised a decisive influence on the fate of mankind — are comprised in the following brief chronological table.

The Creation,	B. C. 4004
The Deluge,	2348
Confusion of Tongues,	2247
Abraham goes to Canaan,	1995
Settlement of Greece,	1836
Departure of the Israelites from Egypt,	1491
Temple of Solomon built,	1004
Building of Rome,	752
Assyrian Empire overthrown,	538
Alexander invades Persia,	330
Greece conquered by the Romans,	146
Carthage destroyed,	146
England invaded by Cæsar,	55
Christ born,	0

* For a view of the present state of society throughout the world, in respect to religion, dress, education, &c., see "Manners and Customs of the principal Nations of the Globe"; and for a view of the industrial pursuits of mankind, see "Enterprise, Industry, and Art of Man." The reader, who wishes to trace the history of mankind, is referred to the several volumes in the Cabinet Library, entitled "Lights and Shadows of Asiatic History," "European History," &c.

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Christ crucified,	A. D. 33
Jerusalem destroyed,	70
Hygenus, first Bishop of Rome, made Pope,	134
Christianity adopted at Rome,	311
Rome divided into the Eastern and Western Empires,	395
Rome taken by Odoacer,	476
The Pope's temporal Power established,	607
Mahomet's Flight — the Hegira,	622
Saracen Empire established,	638
Charlemagne begins his Reign,	772
Egbert first King of England,	827
William, Duke of Normandy, becomes King of England,	1066
The first Crusade,	1096
Turks conquer Constantinople,	1453
America discovered by Columbus,	1492
Reformation of Luther,	1517
Partition of Poland,	1772
American Revolution,	1775
Bastile destroyed, and beginning of French Revolution,	1789
Bonaparte made Emperor,	1804
Battle of Waterloo,	1815
Revolution in Paris and Louis Philippe King,	1830
Chinese open several Ports after a War with the British,	1842

Such is the thread of chronology,* which runs through the tissue of the world's history. We have not space to dilate upon this topic, and can only give a rapid sketch of the progress of society during the present century.

* In this table, we have followed the commonly received chronology; but there is reason to believe that it is defective, and that a considerably longer period than that assigned actually elapsed between the deluge and the confusion of tongues, and the settlement of the different portions of the old world. Some chronologists place the creation of man nearly two thousands years earlier than the time usually adopted, and it is quite probable that this is more nearly correct than our reckoning.

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Whoever has watched the progress of recent events throughout the world has remarked, that, amid change, fluctuation, vicissitude, there is still a general tendency to improvement. Though the surface of the world's affairs may seem to present an aspect like that of the ocean, broken into a chaos of waves, there is still visible, in the midst of it all, and bearing all forward in its current, the resistless march of improvement.

If we take a hasty retrospect of history, within the space of our own observation, — within the compass of the last five and forty years, — we shall see abundant evidence of this. Let us fix our view, for a moment, upon Europe. The first object that arrests our attention is France. At the opening of the present century, we behold her rising from her long intoxication, and still reeling with the banquet of blood, but gradually acquiring stability under a consular government, Napoleon Bonaparte being at its head. We soon see this remarkable man becoming the pivot upon which the affairs of Europe turn. In 1802, he became consul for life; in 1804, emperor. In 1808, he deprived the Pope, who crowned him, of his territories; in 1809, he divorced his wife, and in 1810 allied himself to the haughty House of Hapsburg. Between the commencement of his career and its close, he created three kingdoms, — Bavaria, Saxony, and Wurtemburg. He made his brother Joseph, king of Spain; Louis, king of Holland; Jerome, king of Westphalia; his brother-in-law, Murat, king of Naples; his son-in-law, Eugene, viceroy of Italy. And what do these events imply? The conflict of armies; the overthrow of empires; the dethronement of kings; the termination of

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dynasties. All Europe was shaken as by an earthquake; and in the concussion, political institutions and social edifices, which had been cemented by centuries, and had long defied the shock of ages, were shaken down and crumbled into dust!

For a time, the course of the conqueror is only onward. He arrests the gaze of the world, and the nations look with mingled admiration and fear upon his progress. But a sudden change comes over his fortunes. The waves recoil, and he is overwhelmed. He is the victim of the returning tide, which his own impetus has heaped up. Like Sisiphus, he rolls the rock up the acclivity, but, near the summit of his wishes, his strength fails, and he is crushed beneath the recoiling fragment. A fugitive he returns from Russia, where, two brief months before, he thundered at the palace-gate of the Czars, with three hundred thousand men. He gathers new armies, and meets the enemy at Leipsic; but his struggles are vain. He retreats toward his capital, sustaining defeat after defeat, — until at last he is compelled to resign his crown, and deliver himself up as a prisoner. Paris — the proud capital — is turned into a camp. Russian Cossacks bivouac in the Champs Elysées; the Garden of Plants is occupied by the troops of the Prussian Blucher, and English soldiers mount guard at the palace of the Tuilleries! Bonaparte is banished to Elba; his family is degraded; and the denounced and exiled Bourbon is restored to the throne of his ancestors.

Nor does the wondrous drama end here. In a few months, Bonaparte escapes; he returns to Paris; again he is at the head of armies; again his fortunes are in

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the ascendant. He reigns for a hundred days, and then, after a series of defeats, is finally overpowered at Waterloo, and, surrendering himself into the hands of the English, is sent to St. Helena, where he dies.

And what is the subsequent history of the throne which this man possessed? Louis the Eighteenth dies at a good old age, and is succeeded by Charles the Tenth. A new revolution breaks out; Charles the Tenth abdicates; and the throne is occupied by his relation. And now behold a king's son — a Bourbon — traverses the ocean to that lone isle, where rest the ashes of the mighty dead. With pious reverence he approaches the tomb of Napoleon, and causes his remains to be disinterred. They are borne back to France; they are there received with military honors; tears are shed over the senseless ashes, like rain; in all the pomp and circumstance of human glory, they are deposited in the capital from which, four-and-twenty years before, their possessor had been driven by the embattled hosts of Europe. And this is all a story of the present century, — the story of one man and of a single empire. What a spectacle of vicissitude does the record of nations present! If the curtain be dropped for a few brief years, when again it is rolled up, how changed is the scene! A slight turn of the kaleidoscope, and behold a new arrangement of human affairs, — a new distribution of crowns and thrones and kingdoms.

The history of other nations of Europe presents a similar aspect of agitation and mutation. Within the present century, the king of Portugal has been compelled, in order to save his life, to transfer his throne

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from one hemisphere to another. We have seen him restored to his native country; and after his death, we have beheld his descendants wrangling for the crown, like beasts of prey, and making the blood of the people flow like water in the inglorious strife.

In Spain, we have witnessed still more remarkable events. We have seen a father sell the throne of his son, for a stipulated sum of money. We have seen that throne bestowed upon a stranger. We have seen every hill in the kingdom become a fortress, and every valley an encampment. We have witnessed the conflict of armies led on by Massena, Soult, Ney, Victor, and Marmont, on the one hand, and by Beresford and Wellington on the other. We have witnessed the fights of Talavera, Buzaco, Salamanca, Badajos, and Vittoria.

In 1814, we have seen the cheated and imbecile Ferdinand restored; and we have seen his daughter, by a fourth marriage, in her very infancy, seated on the throne. We have seen her uncle, Don Carlos, striving to wrest the sceptre from the infant's grasp, but, after years of baffled effort, we have seen him give over the ineffectual struggle, still leaving the heaving and swelling elements to agitate the land.

Turning our attention to other countries, we see that within the period of our survey Holland and Belgium have been separated; Greece has passed from vassalage to the Turk to a state of independence; Prussia has risen from relative insignificance to a proud ascendency in the scale of nations; and Russia is arresting the attention of the world by her gigantic strides in civilization, dominion, and power.

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In the great events of the last forty years, England has largely participated. From 1800 to 1815, it is estimated that there were more general actions fought, and more lives lost, than during any former period of ten times the extent. The whole number of engagements — including those of Marengo, Austerlitz, Corunna, Aspen, Esling, Wagram, Barossa, Elbarossa, Borodino, Lutzen, Leipsic, Ligny, and Waterloo — exceed two hundred pitched battles, beside many others of lesser note! In all these, English troops, money, or policy participated. In every battle-field, at every court, in every diplomatic congress, the omnipresent genius of Britain seemed to take a decisive part. Nor have her movements been confined to Europe. Within the present century she has acquired, either by arms or diplomacy, the Cape of Good Hope, Ceylon, Curaçoa, Demarara, St. Eustatius, Mauritius, Madeira, Malta, Martinique, Senegal, and Surinam. In India her empire is doubled; the whole Australian continent and its adjacent isles are hers; the world is dotted with her fortifications; she reigns over one hundred and fifty millions of people, — one fifth part of the human family; and, recently, her armies have been knocking at the door of the most populous empire on the earth, and calling on a nation that has dozed in security and seclusion for ages to awake, arise, and take part in the great movements of mankind.

If we turn from this hasty survey of Europe to our Western continent, we shall remark the same general character of mutation in the course of history. Forty years ago, the United States were the only republic, the only independent nation, in this hemisphere. At the

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commencement of the nineteenth century, this entire continent, save only our country, was in a state of colonial vassalage. And what is the spectacle now? Thirteen independent republics are enrolled in the list of nations, and inscribed on the map of America. Spain, which first discovered this Western world, and for centuries held one half of it in her iron grasp, has unclenched her hold, and millions of people have learned to breathe the unwonted atmosphere of freedom and sovereignty.

And if such be the aspect presented by nations, for the last forty years, we shall note the same characteristics if we turn our attention to individuals. When the morning of the nineteenth century dawned upon the world, who were the master spirits that the sun in his course found in possession of power, or reaching forward toward might, majesty, and dominion? Pitt, Fox, Nelson, Cowper, Gifford, Grattan, Curran, Cuvier, Laplace, Kemble, Siddons, Scott, Byron, Napoleon, Alexander, in one hemisphere; Adams, Jefferson, Madison, Monroe, Harrison, Bolivar, in another. And where are they? They are gone, — faded from the scenes which they once exalted, or perchance adorned. The voice of the orator is hushed; the plume of the chieftain is nodding over his tomb; the lyre of the minstrel is dumb. And yet the world rolls on. If one charioteer is struck from his seat, another hand is ready to grasp the reins. There is change, but no pause. The wheels still move forward. If Bonaparte is swept from the deck, Louis Philippe seizes the helm, and guides the vessel of state; if Alexander dies, Nicholas succeeds, and leads on the march of civilization.

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Such is the spectacle presented by a general view of the world, within our own times, — a space of forty five years, — and one which the imagination may easily measure. But this is the mere outside of affairs. A king is not a kingdom; nor is the story of a ruler always the history of his people. If we look beyond the characters which figure in the foreground of the pageant of history, we shall observe, so long as we fix our attention upon individuals, that all is succession, — mutation. One set of actors appear upon the theatre, play out their parts, disappear, and give place to others. But this is not all: it is not a mere change of scenes and actors, but each successive act in the great drama of human society shows an advancement, an improvement in the condition of mankind.

Look at what has been done for science within the last forty years. Geology has almost entirely grown up within the present century. All former ages had dozed in ignorance and indifference over its mighty revelations. The bones of the mastodon and the ichthiosaurus had been occasionally discovered, and some dreaming philosophers had wondered whence they came; but the knowledge of whole races of animals and vegetables, that had lived, flourished, and perished on this earth before the creation of man, and the existence of the present order of things, — of ages that have rolled over the world, before any being was here to record its history, — of revolutions which have rent the granite ribs of the earth, like shreds, and fires that have fused mountains as in the crucible of a chemist; — all these facts, now indisputably established, are the discoveries — the revelations — of our own day.

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In mineralogy, chemistry, natural history, and natural philosophy, there has been an almost entire revolution. Old theories have become exploded, old errors abandoned, and philosophy founded on facts has become established. And two things are here specially to be remarked. Philosophy, before a sealed book to all but the learned, is now as familiar as household goods. Philosophy is no longer hidden within a sanctuary, to which a privileged class only are admitted, but the doors are thrown wide to the world, and whosoever will, may enter in and partake of its privileges. Science is not only familiar, but it is rendered practical and useful by application to the arts of life. Chemistry is no longer the mystery of the alchemist, nor the black art of the juggler. It is no longer the perquisite of the scholar, nor the plaything of universities. It is in our schools and academies, — it is in our workshops, — in the hands of mechanics and farmers, — practical men, who are every day turning it to practical account. Mankind had before enslaved the horse and the ox, and taught them to toil in his service; they had before taught the rivers to turn the wheel of the mill, the waters to bear their ships, and the winds to speed them on their way; but it is within the present century that Philosophy has been chained to the car of human art, and been made to work for the comfort and pleasure of man. Philosophy — forty years ago a proud, privileged thing, the tool and instrument of the few — is now the slave of the many; before the toy of the scholar, it is now the servant of the people. No longer hidden in colleges, it is at work in the field, on the highway, upon the railroad-track,

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on the great deep, in the mine, in the factory, in the kitchen. No longer is Philosophy a thing that lives aloof from the world, with gloved hand and slippered foot, too dainty to soil itself with the head-work and hand-work of life; — it is now a hard-fisted fellow, with sleeves rolled up, and sweaty brow, tugging and toiling to bless and benefit mankind.

Go to the great cities of the world, and you will find that Philosophy, Science, by application to art, lights them up with gas, and for every inhabitant — the poor as well as the rich — banishes the gloom of night. Go to the machine-shop, and you will find Philosophy there at work, constructing an engine that enables man to fly upon his journey with the speed of the bird. Go to another shop, and you will find Philosophy there, constructing a machine that shall bear you across the Atlantic in a single fortnight. Go to the cotton factory, and you will find Philosophy there at work, and producing a yard of cotton for ten cents, which, forty years ago, had cost you five times that sum.

Thus it is that Science, by its application to the arts of life, by being put into the possession of thousands of ingenious heads and hands, is conquering the great obstacles of nature. It is triumphing over the very shadows of night; it is cutting away mountains; annihilating distance; dragging continents, before separated by the barriers of the deep, into proximity; enabling remote nations to shake hands; and inhabitants of distant cities to breakfast, dine, and sup together.

And now what is the summing up of all this, — of this movement of nations, — this mutation, — this agitation? It is conveyed in a single word, — *improvement.*

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Society has not merely changed its position, but it has made progress. The condition of mankind is improved. Viewed in the great average, man is better and happier. He is better in his political, moral, and social condition. Although the cloud of despotism still hangs foul and heavy over many parts of Christendom, although many dark vices and flagrant wrongs live in the bosom even of Christendom, yet everywhere human rights are better understood and more respected, with a few exceptions. The heart of the despot is either softened with philanthropy, or touched with salutary fear. Prisons, as instruments of tyranny, are getting out of fashion, and iron fetters are not generally in good taste, save perchance in Poland. The Bastile, a type of government but a century ago, is only thought of now as the horrid dream of a departed age. Public opinion, at once the offspring and the guardian of liberty, is springing up everywhere and becoming the bulwark of human rights. Every day the truth, so beautifully expressed by Burns, is becoming more and more familiar to mankind: —

> "The king may make a belted knight, —
> A marquis duke and a' that, —
> But an honest man 's aboon his might, —
> Guid faith he may na fa that.
> The rank is but the guinea stamp,
> The man 's the gold for a' that."

If the intellectual and political condition of the world has improved, so also has its moral. How can we account for the temperance movement throughout Christendom, but on the supposition that there is a higher sense of right in society, than in former times? Can such

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a reform, indeed, be achieved without the diminution of vice, — the promotion of virtue, — the purification of morals? How can we account for the institution of the thousand charitable societies that have sprung up within the last thirty years, but on the supposition of a more enlightened philanthropy warming the hearts of mankind. How can we account for the Bible societies, — the tract societies, — the missionary societies, — sustained as they are by the sacrifices of millions, but on the admission of a deeper feeling of religious duty than before. How can we account for the change in the amusements of people, — the abandonment of theatres, taverns, and scenes of licentiousness, for lyceums and literary associations, — but upon the theory of an improved moral taste! And can these changes take place, — can such mighty engines of moral suasion be brought to act upon society, — touching every class, and every individual, from the highest to the lowest, — without becoming efficient in promoting that improvement of which they are at once the evidence and the consequence?

And, if the moral condition of man is improved, so also are his means of happiness increased. Man's physical power has been at least doubled within the last forty years. The whole force of labor employed in commerce and manufactures alone, in Great Britain, is about equal to that of five millions of men. The steam-engine, which has been brought into operation almost wholly within the present century, in connection with machinery, nearly equals all the direct human power of the kingdom. It would seem probable from these premises, that the steam-engine alone, in applica-

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tion to all branches of labor, within the last forty years, has increased the power of man at least fourfold. It would probably not be overstating the fact, that in Great Britain, the power of man is increased by the aid of modern improvements in machinery at least tenfold; and although there has not been an equal progress in other European countries, still, on the whole, our assumption that man's physical power is doubled within the present century falls far short of the fact.

And as man's physical power has increased, so, on the average, will a man's labor produce twice the amount of comforts and luxuries in 1845 that it would have done in 1745. While the wages of labor, the rewards of every species of industry, are increased, many of the articles we need are cheapened, while few are increased in price. This being the fact, the scale of comfort, the style of living, with the mass is greatly improved.

Thus it is that man's condition, on the broad scale, is improved and improving; his acknowledged political rights are become more ample, and his rights more secure; his moral standing has become more exalted; his mental scope is enlarged; his physical ability has increased; his enjoyments multiplied. Human life is daily becoming a thing of more account; each man's stake in existence is acquiring a higher value.

Such is the general aspect of human affairs, — as presented by that brief but pregnant page of history that has fallen within our survey. On the surface of the stream, everywhere, there is a change, — mutation, — succession. Wave follows wave, — generation follows generation. But while there is change, there

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is advancement. *Agitation* is the characteristic of modern times; and *Improvement* is the result. And now, what is the great instrument of this agitation, — this advancement? What is that which is producing or exciting this fermentation of the elements, and drawing from it a new and better crystallization of society?

The answer is easily given; — it is the PRESS, — the instrument by which human knowledge is recorded and disseminated. It is the *Printing Press*, which speaks with a thousand tongues, — which carries light everywhere, — which analyzes all things, — which penetrates all things, — which has become a lever of more power than that which Archimedes dreamed. It is a lever that not only moves the world, but while it moves, it also benefits mankind. It agitates, — it ploughs up the surface of society, but it produces in the place of weeds the legitimate and useful fruits of cultivation. It sometimes sweeps and rends like the tempest, but it purifies the air, and gives the shrub and tree and flower its refreshing rain. It brings good from what might seem to be evil, and, as it leaves each successive generation better, wiser, and happier, it may reconcile us to that otherwise disheartening fluctuation, which is written on the face of all human things.

The history of the press is in the highest degree interesting; at the same time, it is familiar to most readers. It is not necessary to our purpose to do more than give it a very general notice.

Of the several European claimants to the invention of printing, Guttenburgh seems entitled to the preference; and it would appear that he had succeeded in his experiment about the year 1444. In 1455, he produced

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his forty-two lined Bible, as it is called, because each column consisted of just forty-two lines. Faustus, one of his partners, after separating from him, devoted himself to the printing of Latin and German Bibles. It was matter of astonishment that he could produce them with such celerity, for, before, books were only written with the pen. In those days, a copy of the Bible was worth a good house and farm, and the monks, who derived considerable sums from writing them, seeking to turn the current against Faustus, attributed his invention to the assistance of the Devil. When Faustus paid a visit to Paris to dispose of his books, the charge of sorcery was raised against him, and to save his life, he suddenly disappeared from the city. This gave rise to the popular legend, that he was carried off by his sable Majesty. The partnership firm of "The Devil and Dr. Faustus" is familiar, even in our day.

The invention of printing was kept secret for a time, but about the year 1462, several of the workmen who had been employed by the originators of the art, at Mentz, established presses in different parts of Germany, and also in Italy and France. From this period, it rapidly extended itself over Europe, and has ever since been making progress as well in the facility and cheapness with which printing is performed, as in the beauty and perfection of its execution. Within the last thirty years, immense strides have been made in these respects. The casting of types has been greatly accelerated; machine presses have been invented, and steam, the great worker of the present day, has been applied to them with complete success.

A few simple details will show an almost miraculous

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change which has thus been produced in the art of making books. An expert mechanic will now cast five thousand letters in a day. A good compositor will set up seven thousand, that is, about six common octavo pages, in the same space of time. When these pages are once composed, an almost endless number of impressions may be struck off. By the common hand-press, which was wholly in use twenty years ago, two hundred and fifty impressions may be taken in an hour; but by the steam-press, four thousand impressions may be thrown off in that space of time. Such is the amazing celerity of the process of printing, that in two hours after a British steam-packet arrives, the substance of the news she brings, occupying a newspaper page of close matter, and detailing the doings of an entire hemisphere for several weeks, is spread before the public, and the sheets are sold at a cent apiece!

In six days after a copy of a book is received, — the product it may be of the first minds in Christendom, — it is published here, and sold for twelve and a half cents! Of this, a mechanic may buy ten copies for one day's work. Such are the wonderful results of the invention of the art of printing. Let us look at this matter attentively. Before this invention, that is four hundred years ago, all books were written with a pen. A copy of the Bible required four years of severe labor for its production. And, after all, how inferior in beauty and ease of perusal is the written to the printed copy!

Such, then, are the amazing consequences, — that before the art of printing, a book which now costs fifty cents, and which involves an expenditure of but one

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hour's time for its production, required four years! Thus, by the aid of mechanical invention, man's physical power is increased more than five thousand fold. A man to-day may produce five thousand times as great results by the labor of his hands as he could have done four hundred years ago; and let us reflect that this advantage is applied to the noblest of all purposes, — to the diffusion of knowledge, the dissemination of intellectual and moral light. It is applied to the teaching of human rights and social obligations.

There are some persons of the laboring class, who look upon all inventions with distrust; who regard labor-saving machines with aversion, as if they were conspiracies against them. Is it an injury to the laborer that his power should be increased five thousand fold? Look at the simple fact; — a mechanic, by his wages for a single day, may buy for himself, his family, or his children, as many books as would have cost twelve years of labor in former times! A week's work now, at any common trade, would buy the whole lifetime of a man, and that man a scholar, four hundred years ago. Is this an evil? Let no one be deluded by such idle and absurd fancies. The inventions of modern times are blessings and benedictions to every member of society, and to none more than those who choose, as their vocation in life, the labor of the hands. And among all inventions this which we are considering is the greatest and the best. It is through the application of science to art, — it is through the copartnership of head-work and hand-work, — that knowledge has become the common property of mankind, — free as the vital air. It is by the union of intellectual and moral

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labor, that knowledge, formerly shut up in cloisters and hidden from the world, is now made to flow forth as abundantly as the waters of springs and rivers.

The art of manufacturing paper has advanced with the art of printing. Not more than thirty years ago, machines for paper-making were first adopted, and now they are in general use. By means of these, a roll of paper a mile in length, and of any required width, may be produced. Such is the celerity of the manufacture, that a single mill will now yield a hundred reams a day. You may give your order for that quantity on Monday, and on Thursday, — that is in four days, — if your necessities require such haste, it may be delivered. Some of the sheets produced by the mills in our vicinity are five and a half by sixteen feet, and contain 176 square feet of surface. The paper manufactured at a single mill in a single day, if spread out, would cover four acres and a half of ground; — ten days' work would cover Boston Common!

Such is the brief and rapid sketch of the progress of the several arts connected with the press, — that instrument by which human knowledge is recorded and diffused; that power which is bringing all things, new and old, — opinions, theories, — human thoughts and human institutions, — to the crucible, and testing them by the fiery ordeal of free discussion.

Let us make a brief application of these facts to the subject under review. Printing is but a mode of speech; yet it is speaking with a thousand tongues. It is not merely speaking to the narrow circle around us and within earshot, but to the myriads that compose the boundless republic of letters. It is not speaking only

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to the generation of to-day, but to the generations that rise, wave after wave, upon the shoreless sea of time. Shakspeare, though he has slept in his tomb for more than two centuries, still speaks, and the echoes of his inspired voice are multiplying with the advance of years, and the increase of the world's population. Shakspeare still lives. Every day his power increases,—every day he is becoming more familiar to mankind,—every day he is enlarging his acquaintance, and stooping from the exclusiveness of former times to companionship with the cottage and the cabin. There are probably forty thousand volumes of his works published every year. There cannot be less than a million of his volumes now in existence; and what must be the effect on the world of a million Shakspeares thus speaking to mankind?

About twenty years since, Mrs. Hannah More told the writer of these pages, that one million copies of her work — "The Village Politician" — were published in a single year. Mr. Ballantine, Sir Walter Scott's publisher, stated about the same period, that he had forty thousand volumes of the several works of that author then in press. The whole number of volumes of Sir Walter's works printed within the last forty years amounts to at least five millions! and probably these may have been read by four times that number of persons. Think of the impulse given to the world by such a man thus speaking to an audience of twenty millions of people!

The extent of the book operations of the present day is immense, and its effect on society must be beyond conception. The amount of books sent annually from

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the Eastern States across the Alleghanies is over a million of dollars. The whole production of the trade here, we have no means of ascertaining; but several millions of volumes are published each year. All this is exclusive of the magazines, some of which issue 300,000 numbers a year. It is probable that the entire annual aggregate is not less than three millions of numbers. To this we must add the operations of the newspaper press. The whole number of newspapers in the United States is not less than fifteen hundred, — and the whole number of sheets annually issued cannot be much less than one hundred and fifty millions!

Such is the press in a single country, — and in order to comprehend its power, let us look a moment at the process of its operation upon society. Let each one judge for himself. What is the influence upon your own mind of the newspaper that comes to you, daily or weekly? If it be political, does it not become your schoolmaster, gradually but surely training your thoughts, opinions, and feelings into affinity with its own? Does it not win your confidence, — obtain the mastery over your mind, and become at last your oracle? Do you not by aptitude, by habit, believe its statements, adopt its views, imbibe its feelings? And if this be so, what must be the effect on a nation of one hundred millions of sheets annually distributed among the people, and thus electrifying the whole mass.

And is not the effect of the religious periodical the same? Does not this, if taken into the family, exert a similar influence? And the literary periodical, — does not this, too, control our opinions, shape our feelings, and mould or modify our taste? Nor is the influence

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of books of inferior force. How many a youth has had his whole soul roused to an irresistible desire to follow the sea, by reading the enchanting tale of Robinson Crusoe. How many a mind has been driven awreck upon the dreary shores of infidelity by the specious but vain philosophy of Voltaire? What a mighty influence did the writings of Byron exert upon society, during the earlier periods of his career, fashioning the literature of the day, and changing the standards of taste and morals? It is matter of notoriety, that one of the first novels of Bulwer had the effect of converting the fops of the day, as well in England as here, into imitators of Pelham, the hero of the story. When Pope's reputation was at its height in London, he not only became the model in poetry, but, as he had a habit of carrying his head on his left shoulder, this trick became a mark of fashion and gentility in the higher circles. Stillingfleet, in former times, wore blue stockings, and, being a man of high literary rank, and member of a female literary club, the term *blue-stocking* became the designation of a female addicted to literature.

These instances show the power of books on the mind, — they show the dominion which literary genius exercises over society. And the reasons are these. As before remarked, printing is speaking, and we are made by our Creator to sympathize with speech; even though the voice and image of the speaker be absent, still the communion exists, and exerts its power upon us. Beside, there is a magic in print, which casts a spell over our minds and hearts. We often believe a statement in print, made by a man we know, and

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whose spoken word we should reject as the idle wind. An editor of a newspaper, whom we know to be worthless, profligate, and false, we still trust when he speaks in print.

That each individual may test the power of books over his own mind, let him sit down to the perusal of Scott's story of the Crusaders. How soon is the reader transported to the sands of Syria, and by the aid of the enchanter made to live and breathe and sympathize with those that lived eight hundred years ago. How completely does he lose his own identity, and give himself up to the new existence that is bestowed upon him. How willingly, how completely, does he surrender himself to the guidance of his master! He is mounted upon a wild horse, and, throwing the reins upon his neck, follows, reckless, in the chase. And when the tale is told, when the book is closed, still what lasting impressions are made upon the reader! Scenes and sentiments have been stamped upon the softened and seduced bosom, which time can never efface.

The press, then, is the instrument by which man speaks to his fellow-man, and that, too, with authority. It is the instrument which genius employs when it seeks to stir the human heart, and, like the trumpet of the warrior, it adds its own magic power to swell the tones of him who wakes the blast!

Such is a faint and feeble view of the press, toiling with its myriad hands in the production of books, pamphlets, magazines, and newspapers! Let it be considered that these are speaking to the world with authority, that these are the vehicles by which truth, myriad-tongued, is addressing the nations; by which

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liberty in all lands, and often through the grated windows of the dungeon, is appealing to the sympathy of mankind for enlargement; let it be considered that falsehood, too, and vice, and folly, and delusion, in a thousand forms, are wielding the press, and leading captive those whom they may seduce to their snares. Let us consider these things, and we may then compass, in some degree, the magnitude and importance of the subject we are discussing. We may see, that to human society the press is like the winds of heaven, sweeping over the sea, often lashing it into foam, or perchance fanning it with gentle breezes; but, on the whole, causing a wholesome agitation, and redeeming it from the evils which would fester in its bosom, if left to stagnation.

We cannot now enter into details to illustrate and establish these views, but it may be well to note a few of the advantages which must flow from the extension of the press to which we have referred. In the first place, it secures the advancement of society in knowledge and civilization. Whatever is known is recorded in so many forms, that no event, unless it be one which is coextensive with the surface of the world, and which blots out mankind from existence, can quench its light. Libraries in many languages are now scattered over the world. If Europe were desolated by flood or fire, the libraries of America, Asia, Africa, and the islands of the sea, would still exist, and perpetuate the arts, sciences, and philosophy of the present age. In the days of antiquity, knowledge has flourished, — the arts have existed, — philosophy has prevailed; but all these have been lost and forgotten, in the oblivion of centu-

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ries, only because the destinies of an empire were changed. The ruins of Egypt unfold to us a wondrous revelation; after slumbering for thirty centuries in the tomb, they now rise up to tell us that human art and science have flourished and have perished! But henceforward this can no more happen. Knowledge can have no diminution; it must advance, increase, accumulate, and bear the world forward upon its bosom. The recorded mass of human lore insures this, and we may say, that as certainly as the collision of the flint and steel elicit light and heat, so surely do discussion and the diffusion of knowledge enlighten, elevate, and purify mankind.

One of the processes by which the free press benefits society is that it begets public opinion, and gives this the means of making itself heard and felt. It introduces a new arena, — a new tribunal, in which men act, — before which they are tried. It sets up a new regulator of society, and that the safest and best that has ever been devised. What is there that exerts such a power over the actions of men as the judgment of society among which they live, when that may be freely pronounced through the press?

But, if such be the influence of the press, it must be remembered, that, like any other instrument given up to discretionary exercise, it is a power of evil as well as of good, — of death as well as of life. The responsibility, therefore, under which we use it, is proportioned to the energy with which it acts. No man should print a line, without questioning himself in the serious words of Pope, — whether it be such as "dying, he would wish to blot." What mighty consequences, for

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good or ill, have flowed from the hasty and inconsiderate works of authors! The celebrated Marseilles Hymn, the ebullition of a moment, is said to have cost the lives of a hundred thousand Frenchmen. Burns's "Cotter's Saturday Night," a poem that will last for ever, was written for a stonecutter, in payment of a tombstone for the poet's father. How little did Shakspeare, after closing his theatrical career, and retiring to his native village of Avon, utterly unconscious of the mighty deeds he had done, — how little did he think of the consequences for time and eternity that would continue to flow from his actions, countless and ceaseless as the waves that break over Niagara. It is one of the incidents of history that an Indian of South America, while climbing a mountain, in pursuit of a deer, laid hold of a tree, which gave way and disclosed a mass of shining silver beneath its roots. Thus were discovered the mines of Potosi, which, while they have poured millions into the coffers of the Spaniard, have proved the tomb of thousands of the enslaved natives of the soil; and thus an author of genius has often opened a mine, as if by accident, which has proved inexhaustible, for good or evil, to his fellow-man. A single spark of fire, carelessly used, has often laid a city in ashes, and this affords but a faint illustration of the mischiefs that have been produced by a single line, or a single couplet, to which genius has communicated its fire, and vice its poison.

There is an especial degree of responsibility resting upon him who presides over the periodical press.

> "The editor — a thing of thousand tongues —
> Speaking aloud with nation-stirring lungs."

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Such an individual is working a mighty engine, for weal or woe, and though we have admitted that on the whole the press is a great blessing, — the crucible and the fire which purify and exalt society, — there is still no excuse for him who abuses it. "Offences must come, but woe to him by whom they come." A man who palters with truth in print multiplies his falsehood by every impression he sends forth; a writer who puts pernicious principles in print is responsible for the evil he may do to the thousands and tens of thousands into whose hands they may fall. Such, in fact, is the recklessness, profligacy, and malice of many individuals connected with the periodical press, that eminent individuals have denounced it as a curse. But let us not confound the evil with the good, nor banish a salutary institution, because it may be abused. Let us rather discriminate between the good and bad, and, while we award honor to the virtuous, let the unmeasured reprobation of society rest upon the head of the manager of the periodical press who uses it for the diffusion of falsehood, scandal, vice, and corruption. Let not the world tolerate wickedness, because it may be cleverly presented, nor excuse indecency, even if it be allied to wit. There is no redemption for vice; no amulet that can make it safe to become familiar with pollution.

The responsibility of this subject rests not wholly with authors, but partly, nay, mainly, with readers. If it be true that the book, the magazine, the newspaper, exerts a power over us almost amounting to destiny, shall we thoughtlessly and inconsiderately read them, and thus place ourselves under their influence? Ought we not to be as careful of the books and papers we

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read, as of the company we keep? Nay, ought we not to be more circumspect in this matter, for these things exert a power over us, for good or ill, which is likely to be decisive of our character and our career. Above all, let fathers and mothers, — the guides and guardians of youth, — be heedful of the newspaper, the magazine, the books they take into the house, to mould the mind and heart of those whom God has committed to their charge. We saw it stated not long since, in one of the papers, that a young man, under conviction of some capital offence, and about to expiate his crime upon the gallows, declared that he had taken to criminal courses from the impressions made upon his mind by reading one of the popular novels of the day. What would not the mother of that boy have given, when she heard of his crime, — when she heard of his trial, — when she knew of the painful and ignominious death he must die, — if, with a mother's care, she had kept that fatal book, from the perusal of her child! Let parents be warned in time. Let them remember that books are like companions, and that they speak with authority. Let them remember that evil communications not only corrupt good manners, but that the heart itself may become fatally contaminated.

This, then, is the summing up of that portion of history which falls within the present century; — that the present age is peculiarly marked as one of mutation, — an era in which things new and old are irreverently huddled into the seething caldron of opinion, from which, however, by the magic power of the free press,

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the bright, living crystals of truth are made to shoot forth. To speak in terms familiar to every ear, the Spirit of the Nineteenth Century is a spirit which questions all things; which analyzes all things; which tries all things, and, by the light of reason and common sense, renders its verdict, with little respect to the past. In the midst of this movement, and among its very leaders, we may remark many who have more zeal than discretion, and who are guided rather by the vanity of being seen and heard, than by truth or humanity. We may notice also the profane, the reckless, and the selfish, drifting with the stream, and, perchance, turning its eddies and ripples to their own small account. These, like the flies that light in the jaws of the crocodile, are doomed to destruction. But it is some consolation to know that the wrath of man, now as ever, is made to praise God, and to see that Christianity, religion, and morality, as our fathers bequeathed them, still rise above the tide, and seem to grow stronger by the very surges that break against their foundations.

THE END.

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